US009452889B2

(12) **United States Patent**
Berthelsen et al.

(10) **Patent No.: US 9,452,889 B2**
(45) **Date of Patent: Sep. 27, 2016**

(54) **BEARINGLESS RECIPROCATING SLAT-TYPE CONVEYOR ASSEMBLIES**

(71) Applicant: **Hallco Industries, Inc.**, Tillamook, OR (US)

(72) Inventors: **Timothy M. Berthelsen**, Tillamook, OR (US); **Brady L. Byers**, Tillamook, OR (US); **Gregory P. Danis**, Tillamook, OR (US)

(73) Assignee: **Hallco Industries Inc.**, Tillamook, OR (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 146 days.

(21) Appl. No.: **14/099,909**

(22) Filed: **Dec. 6, 2013**

(65) **Prior Publication Data**

US 2014/0090960 A1 Apr. 3, 2014

Related U.S. Application Data

(63) Continuation of application No. PCT/US2013/031815, filed on Mar. 15, 2013, and a continuation-in-part of application No. 13/089,307, filed on Apr. 18, 2011, now Pat. No. 8,616,365, which is a continuation-in-part of application No. 12/332,335, filed on Dec. 10, 2008, now Pat. No. 7,926,646.

(51) **Int. Cl.**
B65G 25/06 (2006.01)

(52) **U.S. Cl.**
CPC ***B65G 25/065*** (2013.01)

(58) **Field of Classification Search**
CPC B65G 25/065
See application file for complete search history.

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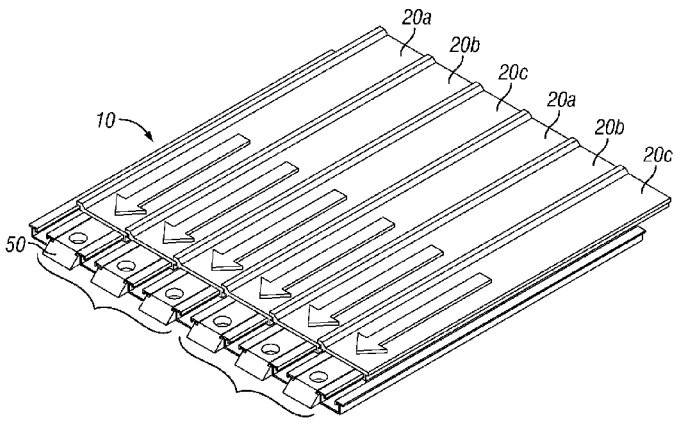
Primary Examiner — Mark A Deuble
(74) *Attorney, Agent, or Firm* — Law Office of Karen Dana Oster, LLC

(57) **ABSTRACT**

A tipper retrofit bearingless reciprocating slat-type conveyor assembly **200** for use in a load-holding compartment including a plurality of elongate hold down strips **220**, a plurality of elongate guide trough subdecks **230**, and a plurality of longitudinal slats **210** adjacent to and parallel to each other is described herein. Also described herein is a snap together bearingless reciprocating slat conveyor for use in a load-holding compartment (that has at least one cross-member having an overhang) that includes at least one reciprocating slat-type conveyor assembly **300**, **400** and at least one elongate slat **310**, **410** at least partially supported by at least one subdeck **330**, **430**. The at least one reciprocating slat-type conveyor assembly preferably includes at least one anchor **320**, **420** (having at least one upper anchor subdeck engager **322**, **422** and at least one lower anchor cross-member engager **324**, **424**) and at least one subdeck **330**, **430** (having at least one upper subdeck anchor-slat engager **320**, **420** and at least one lower subdeck cross-member engager **344**, **444**).

27 Claims, 22 Drawing Sheets



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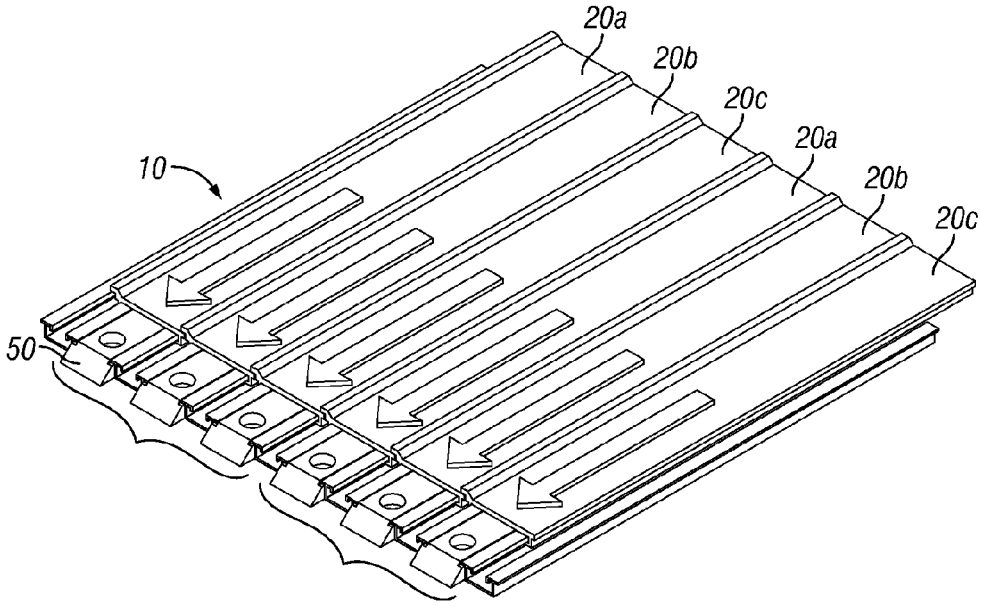
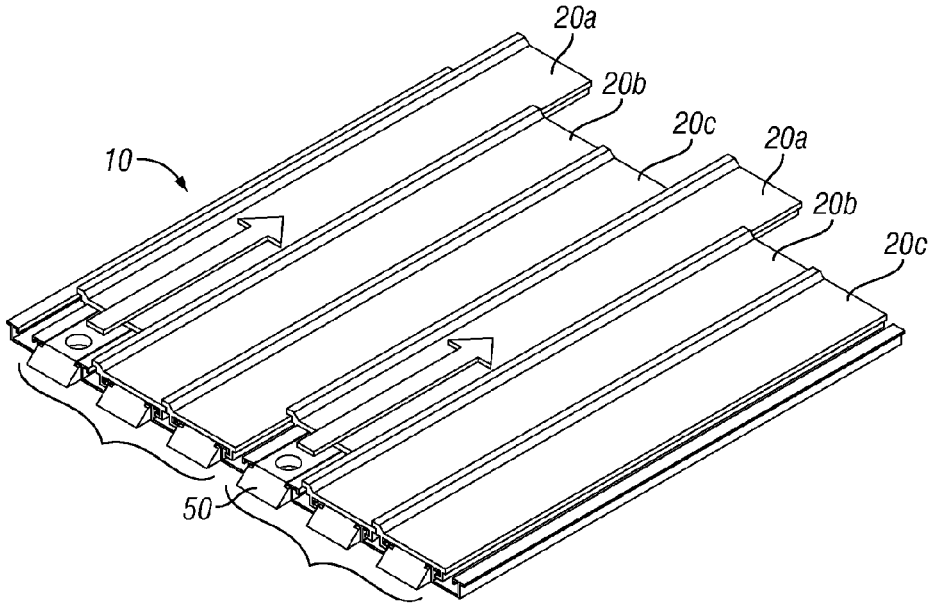


FIG. 1



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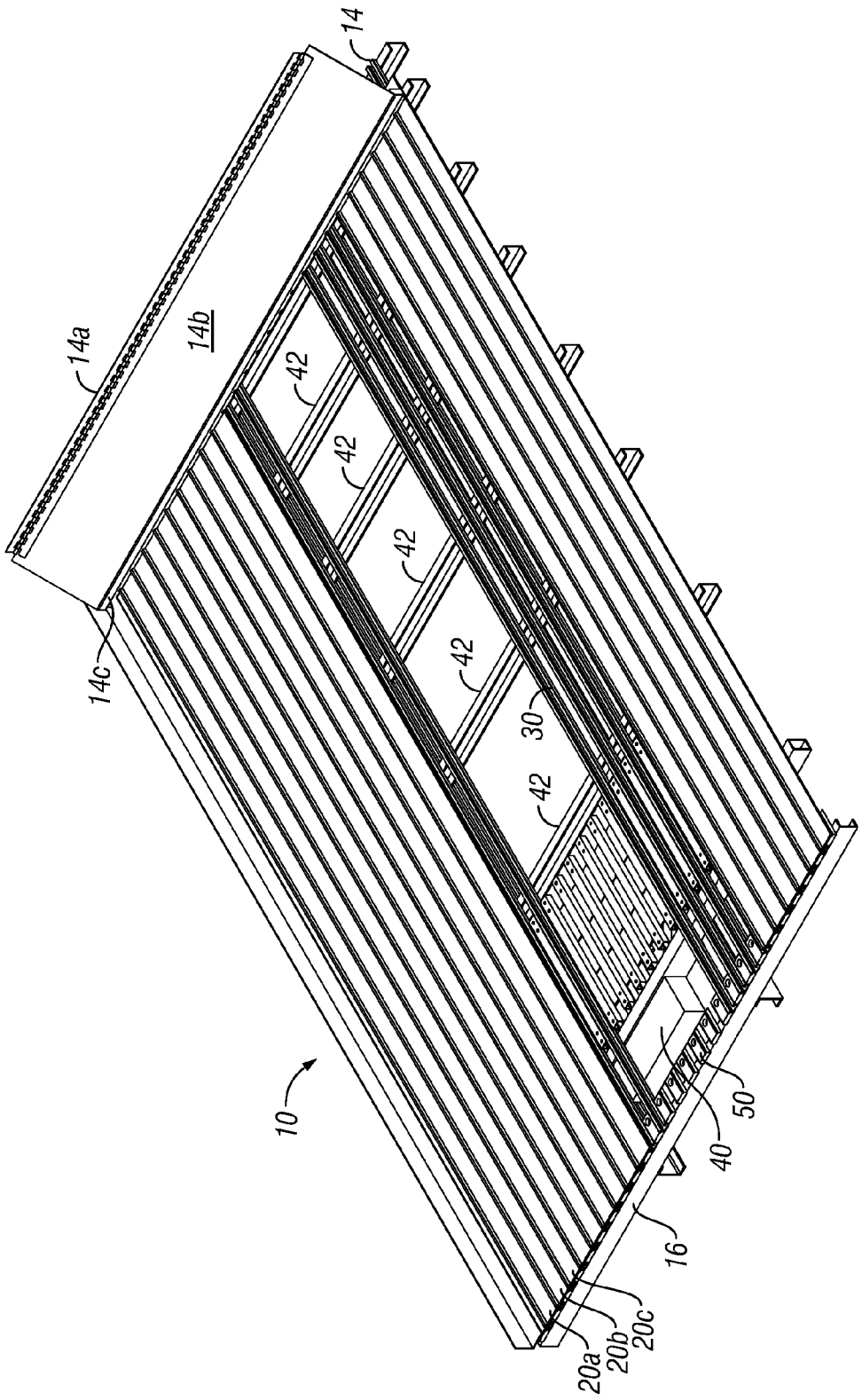

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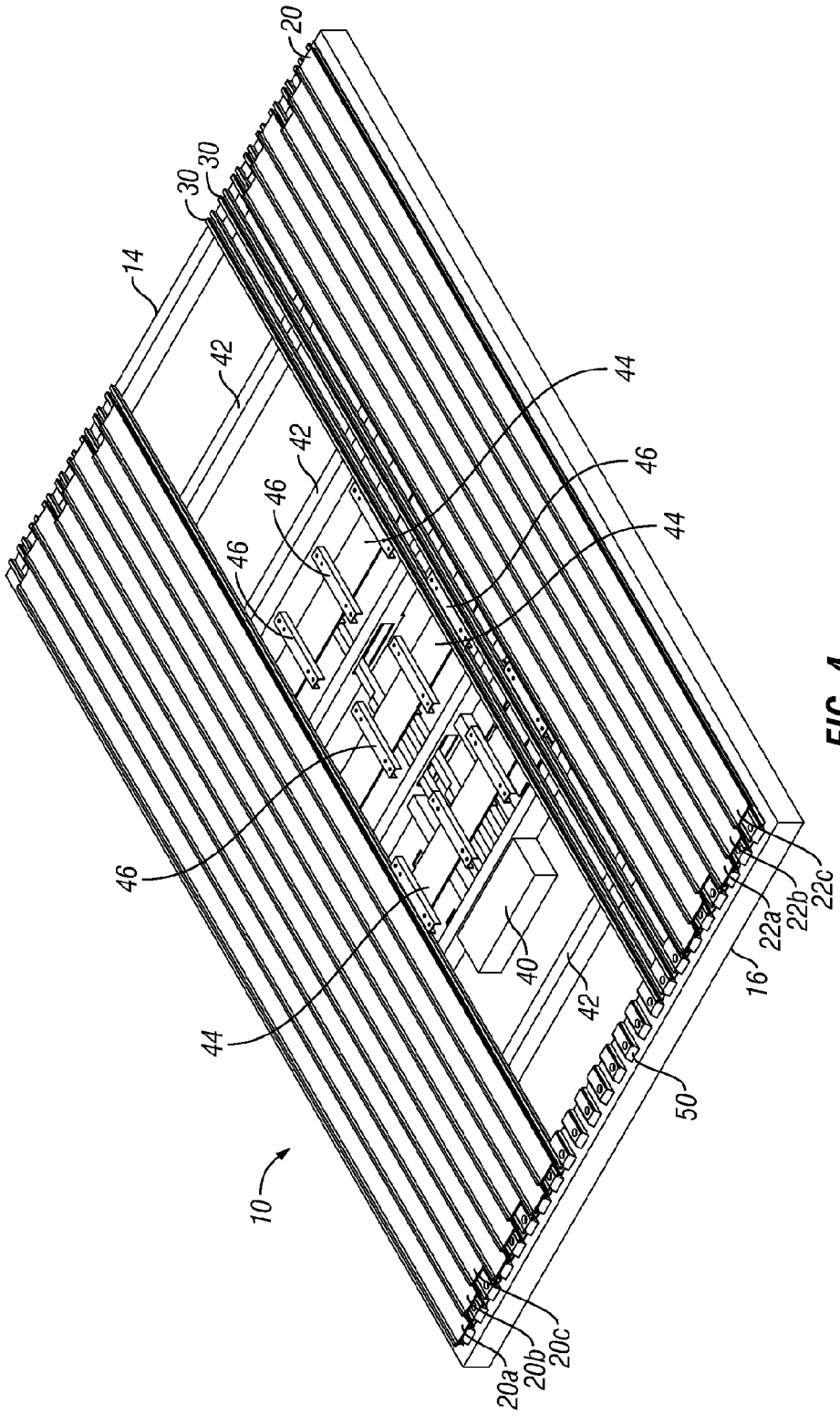
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FIG. 4

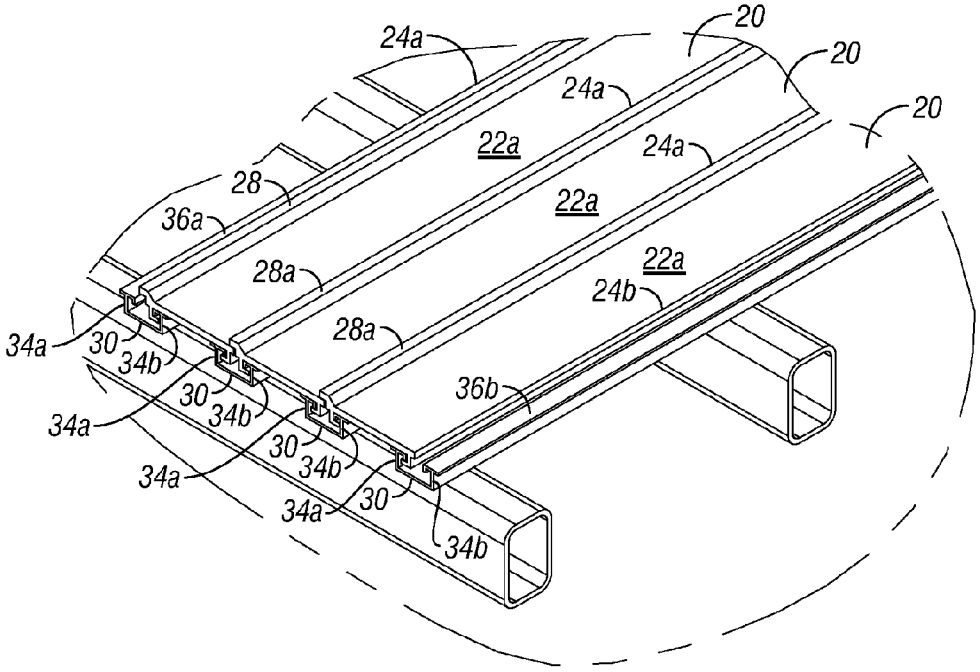
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FIG. 5

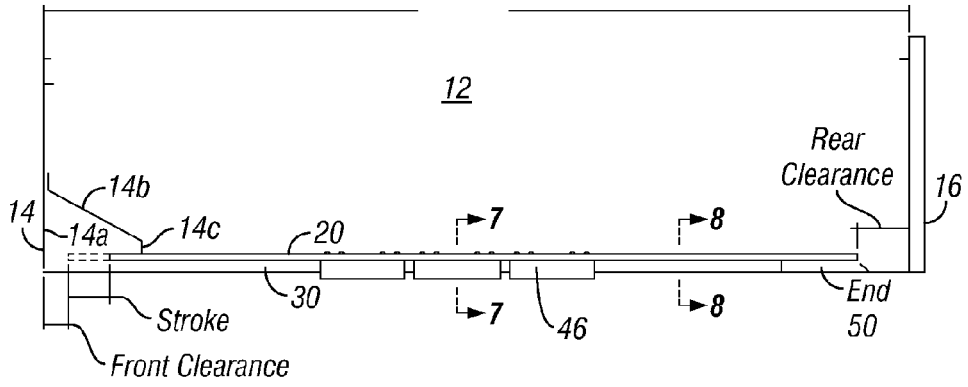
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FIG. 6

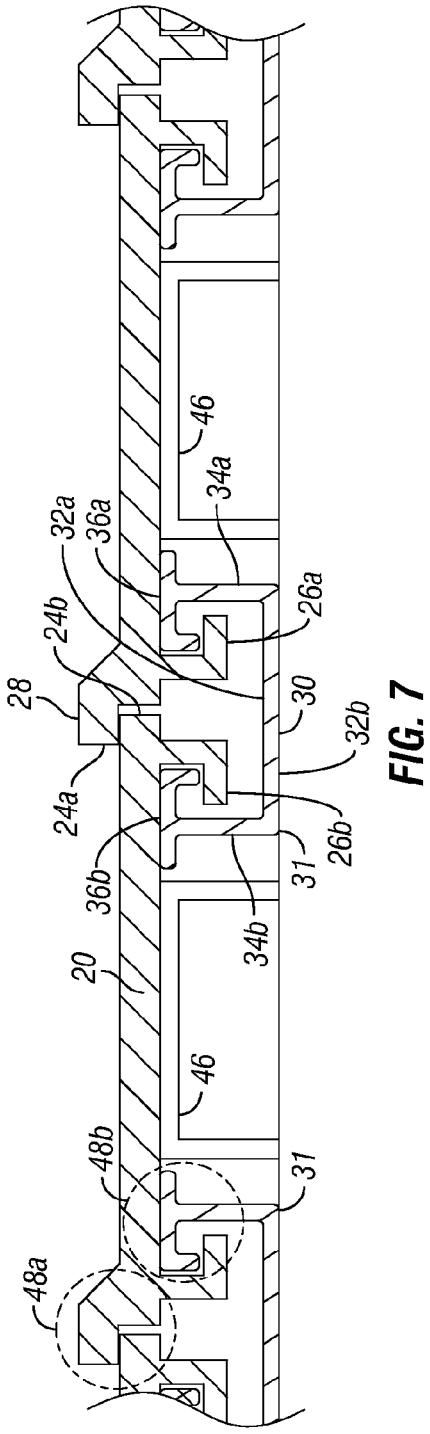
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FIG. 7

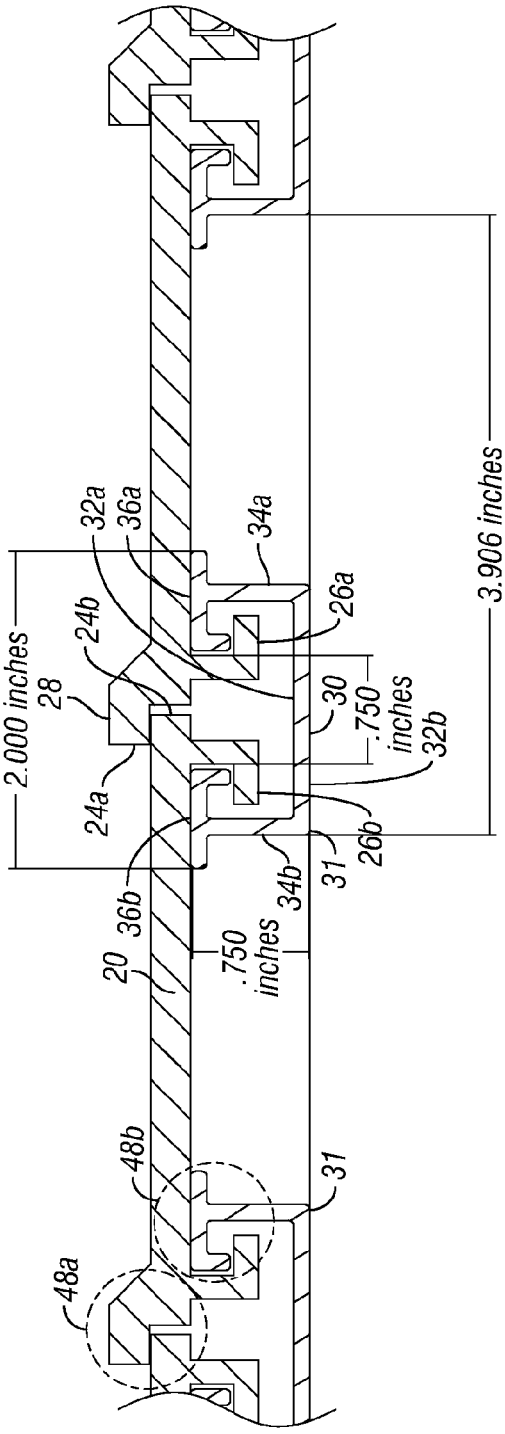
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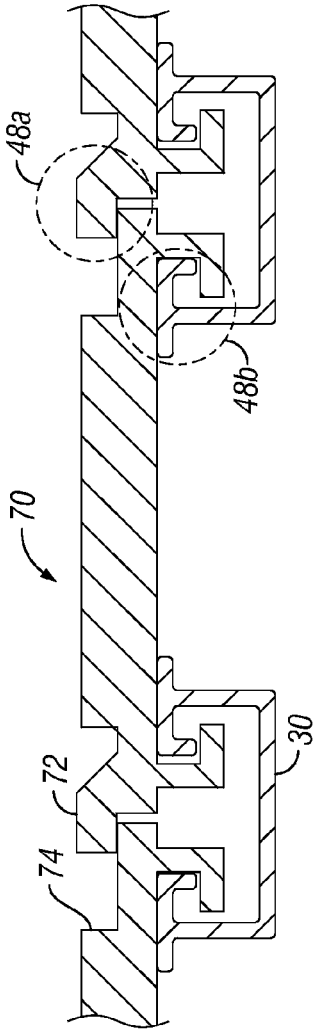
FIG. 8



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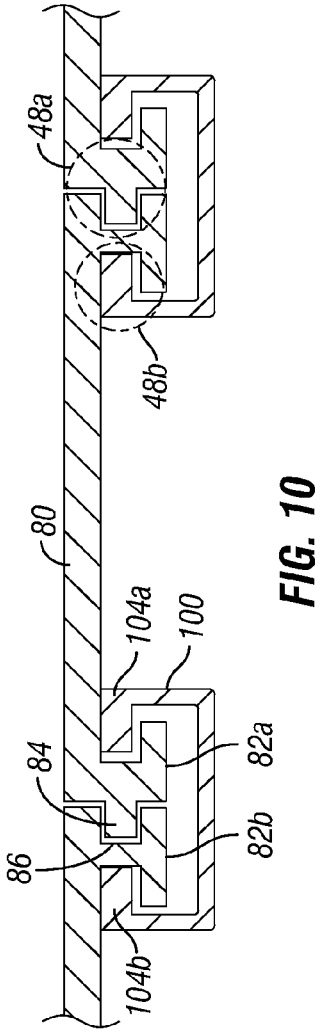

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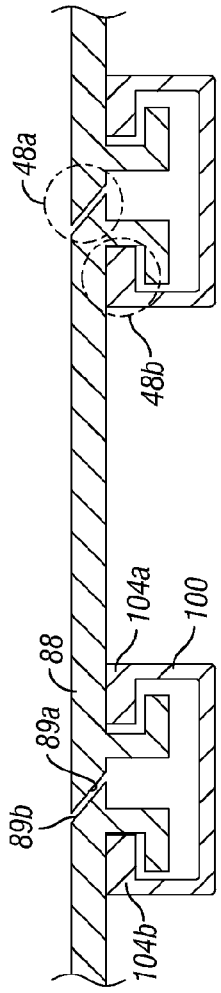

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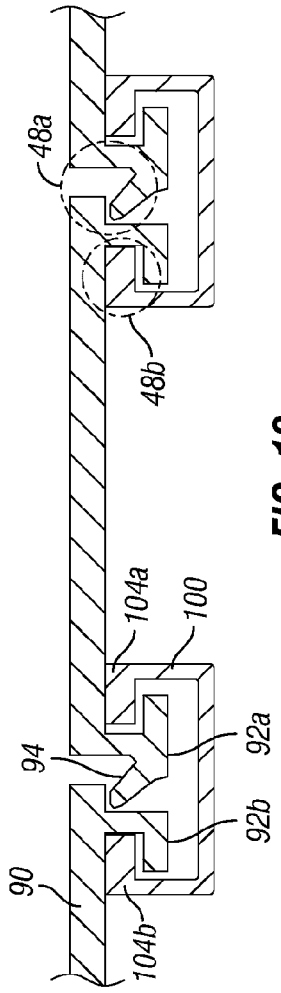

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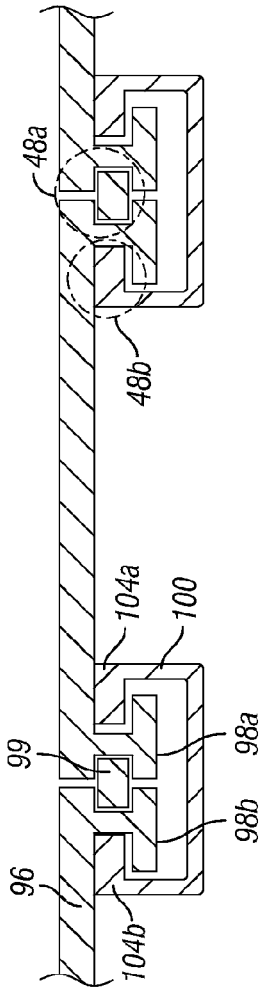

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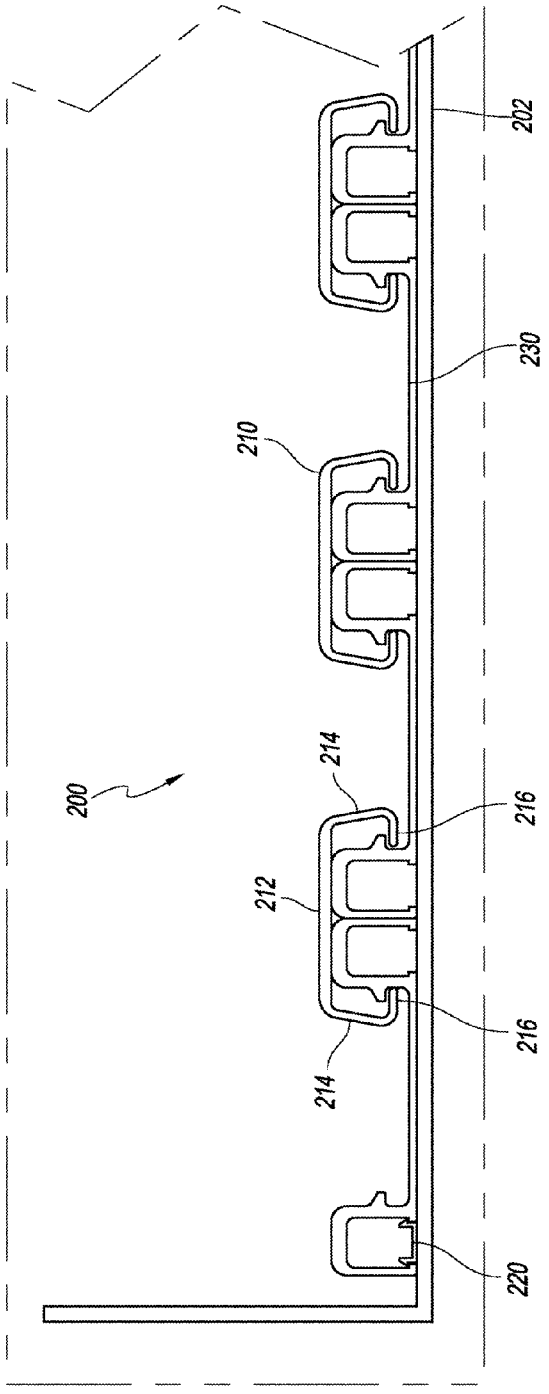
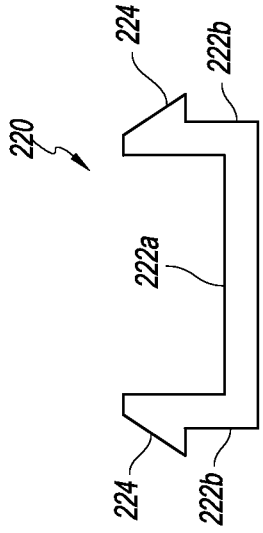


FIG. 14



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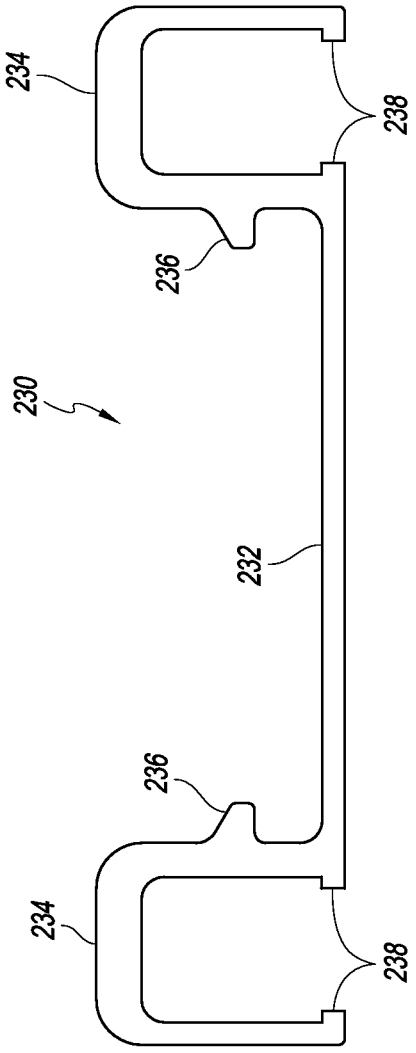

FIG. 16

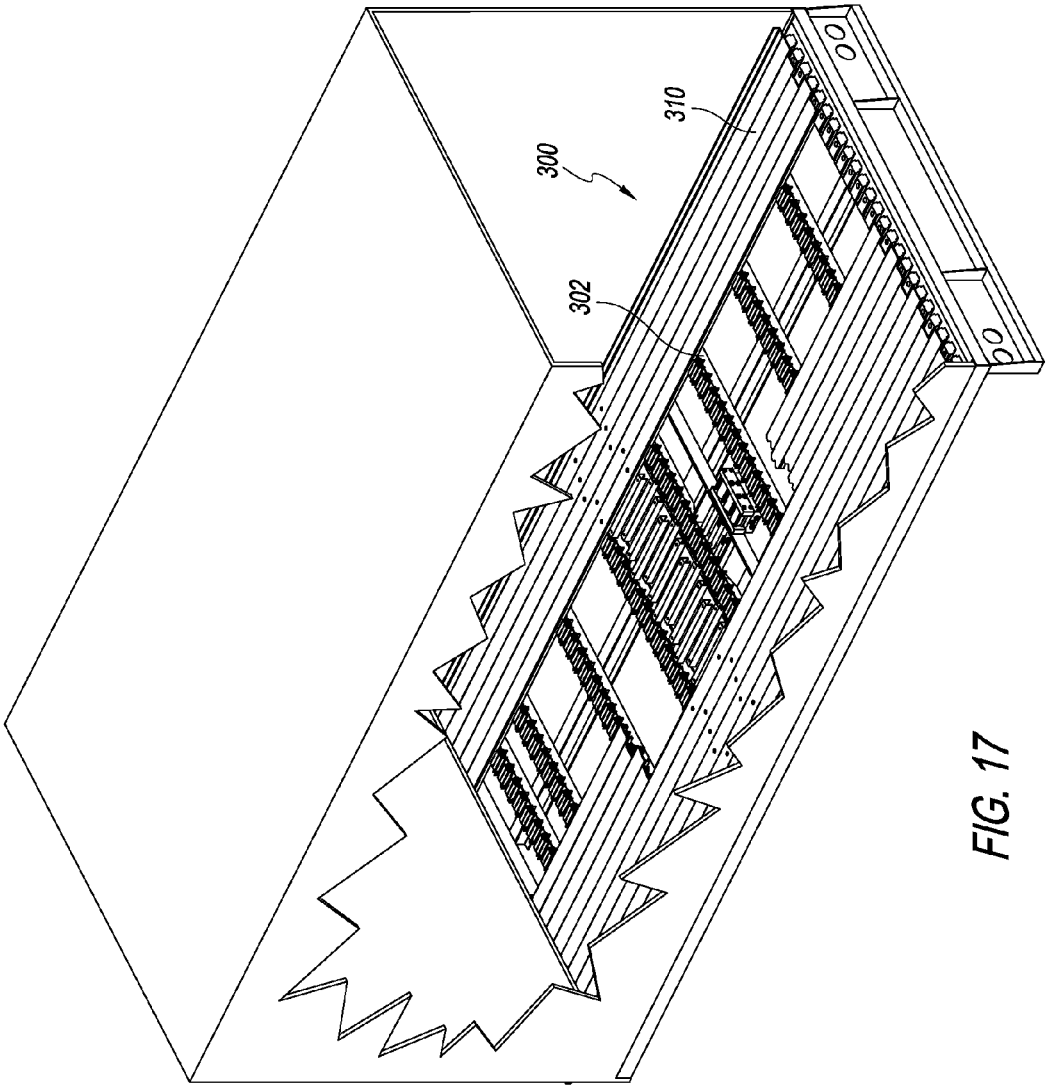

FIG. 17

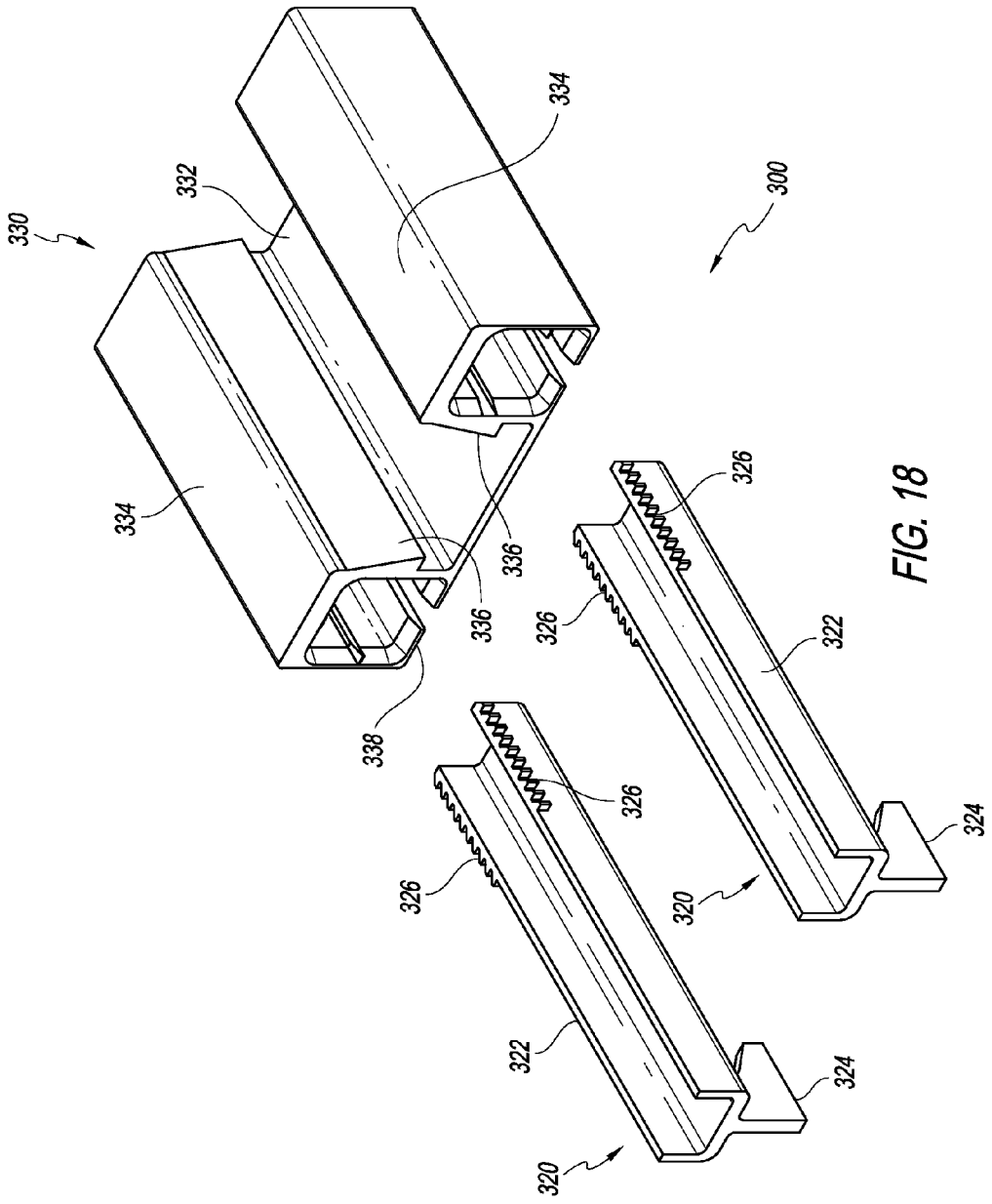
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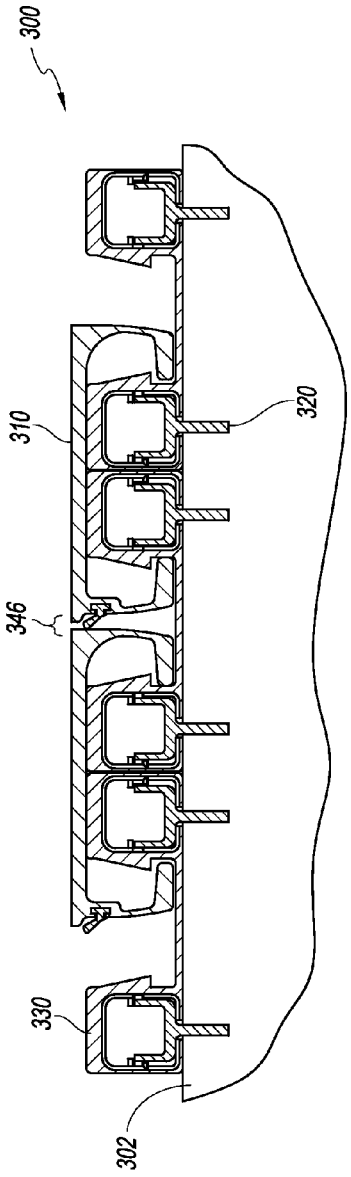
FIG. 18



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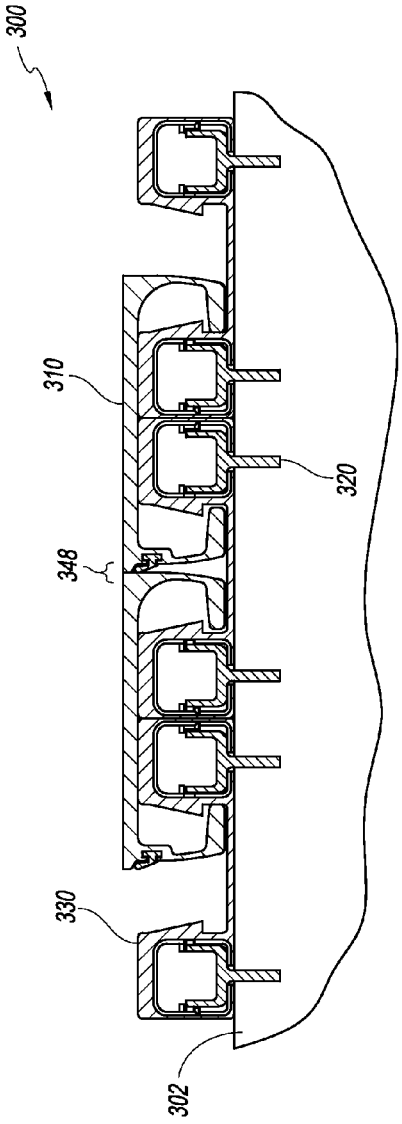

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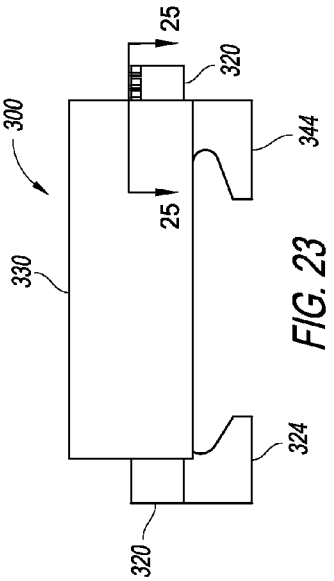

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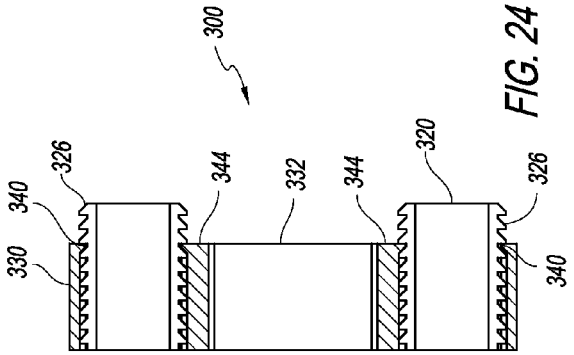

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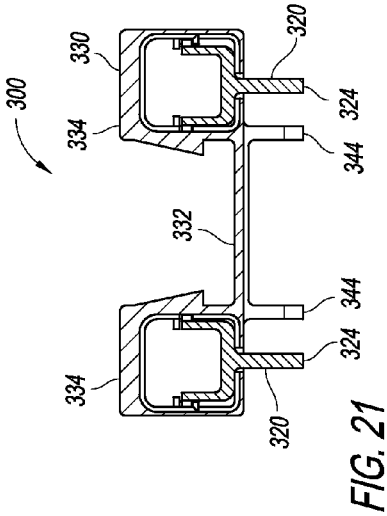

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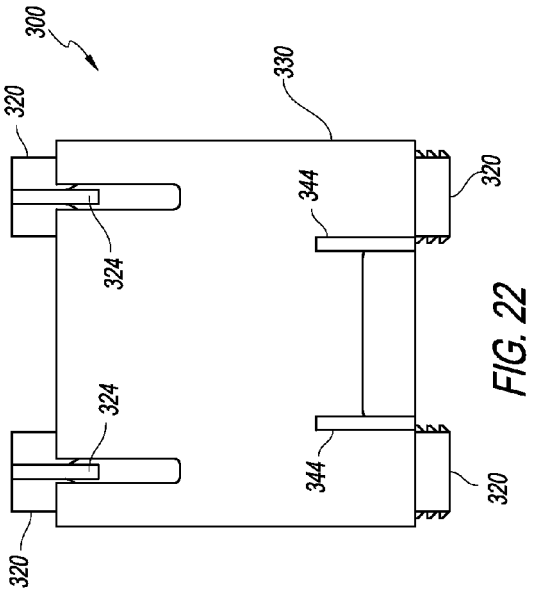

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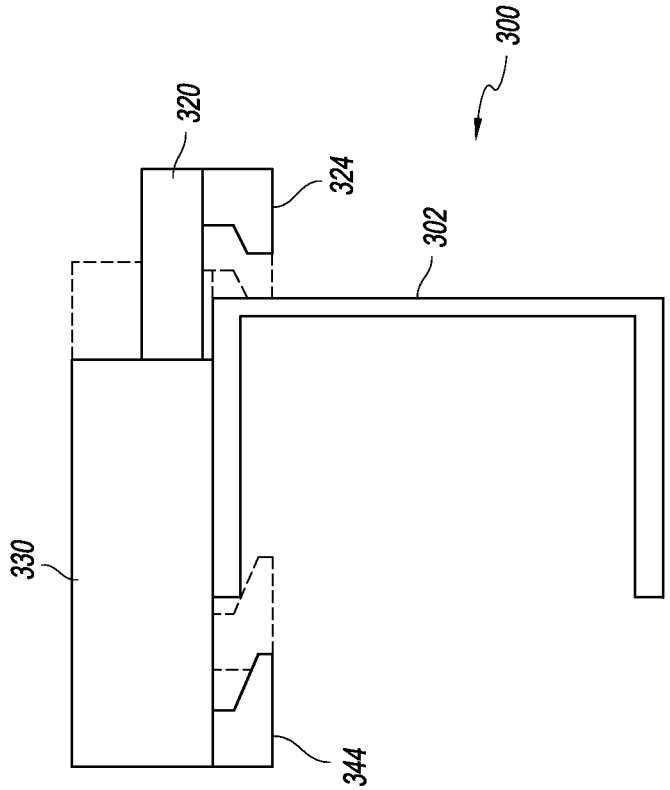

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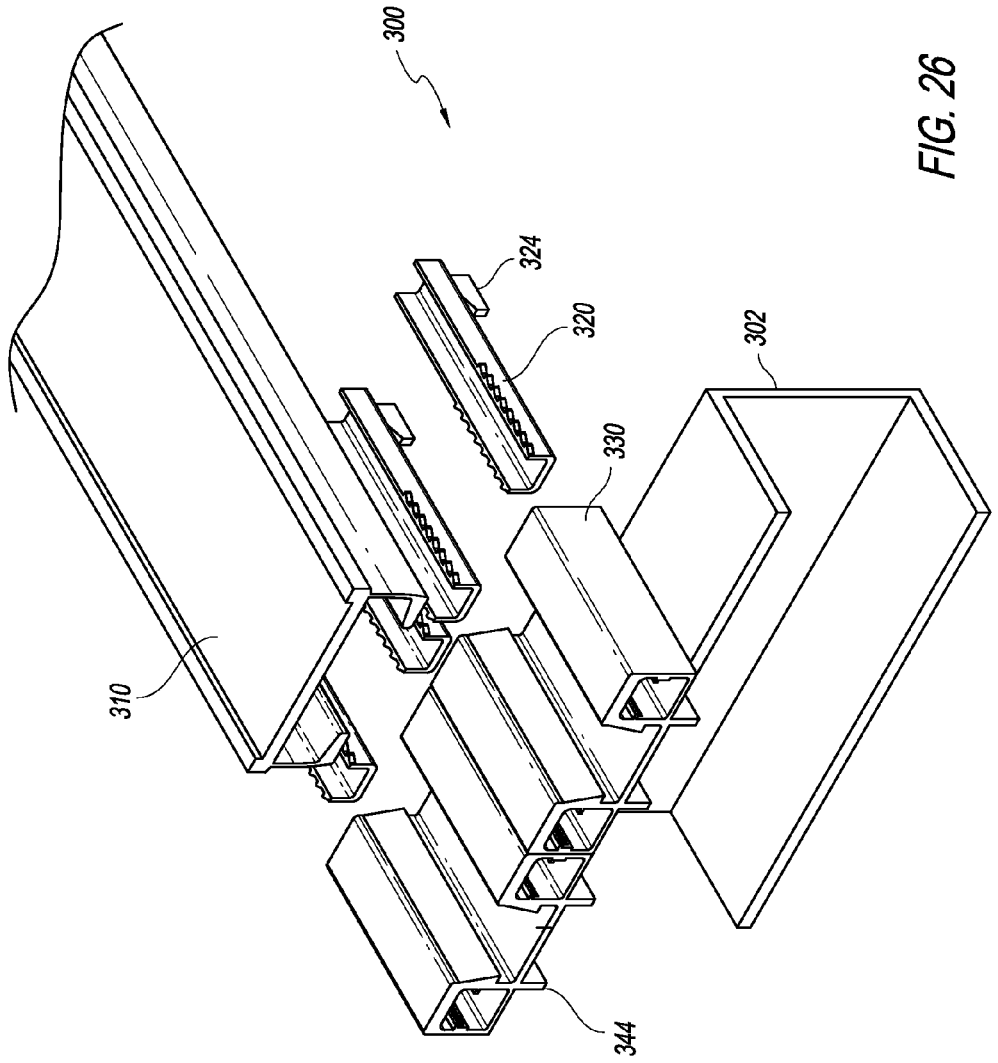

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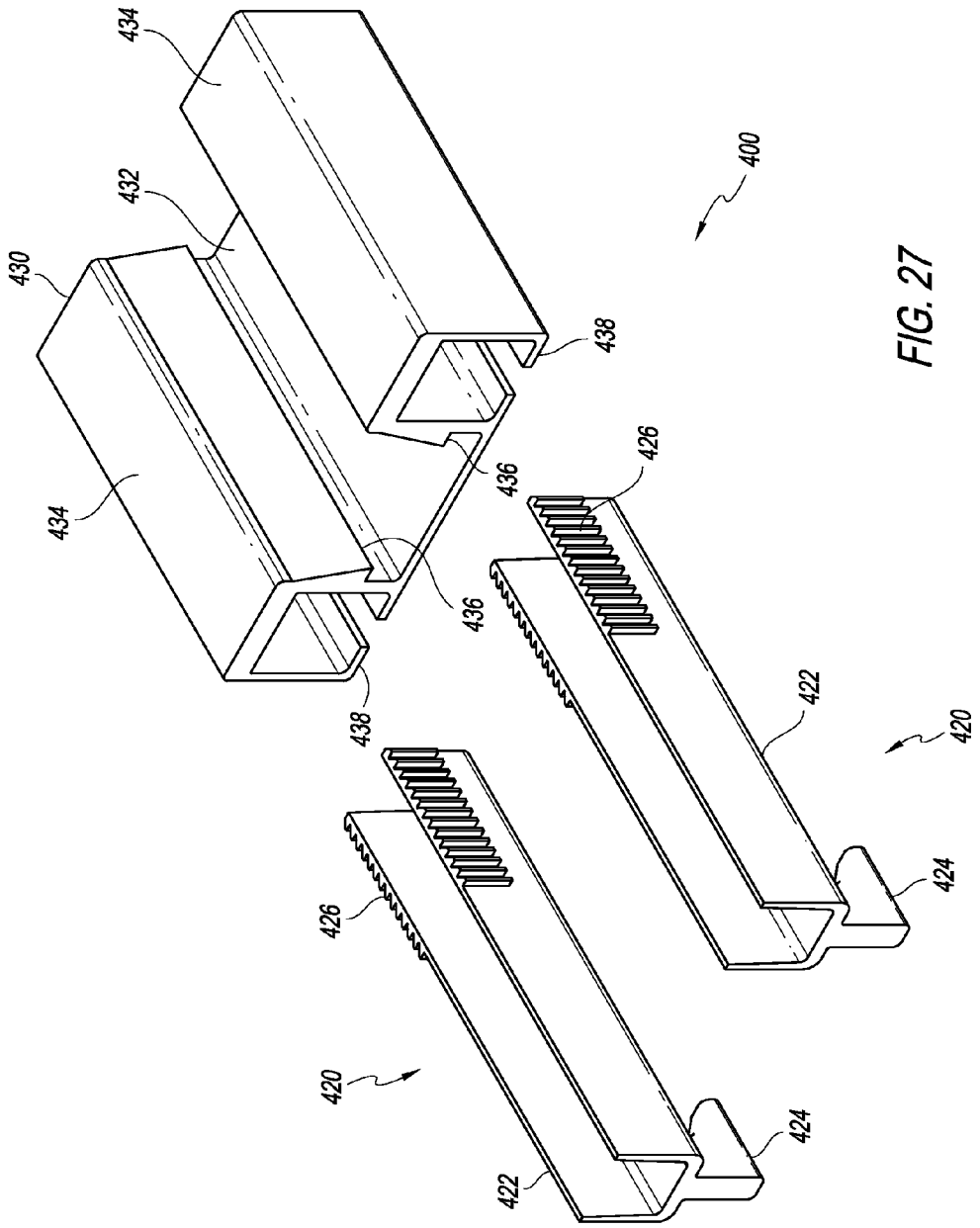
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FIG. 27

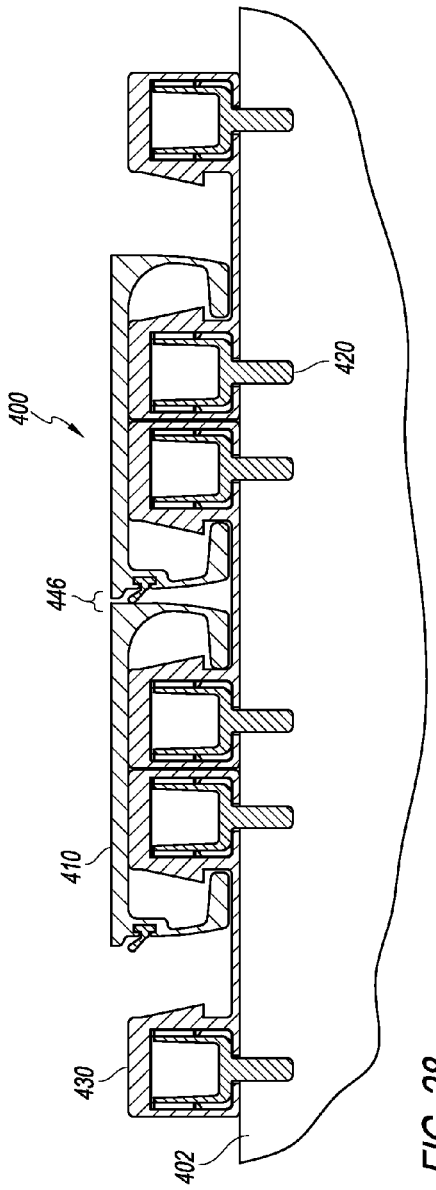
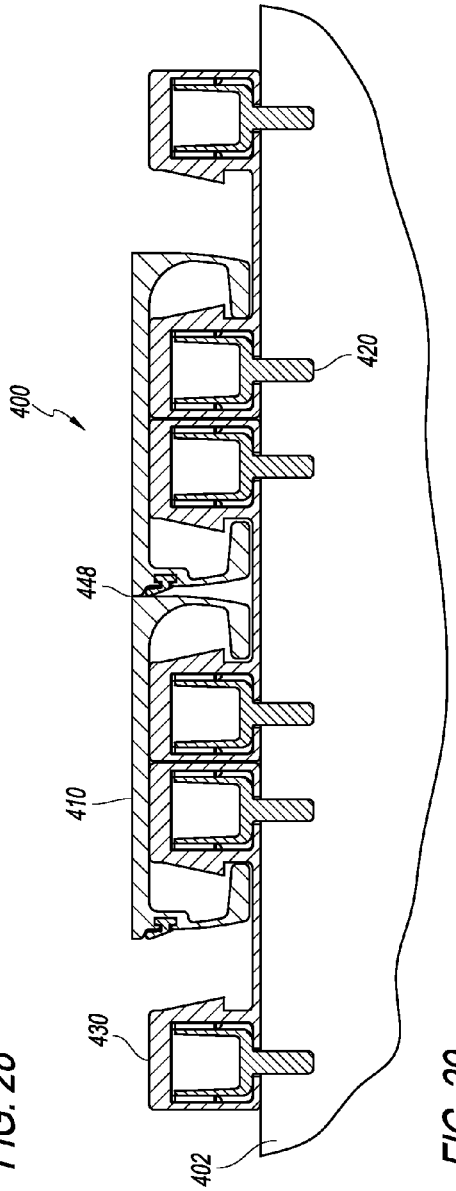


FIG. 28



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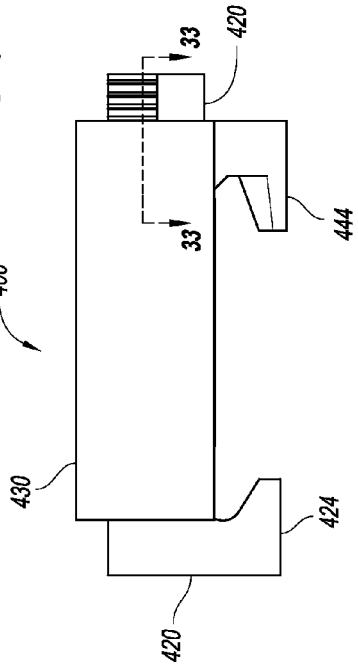

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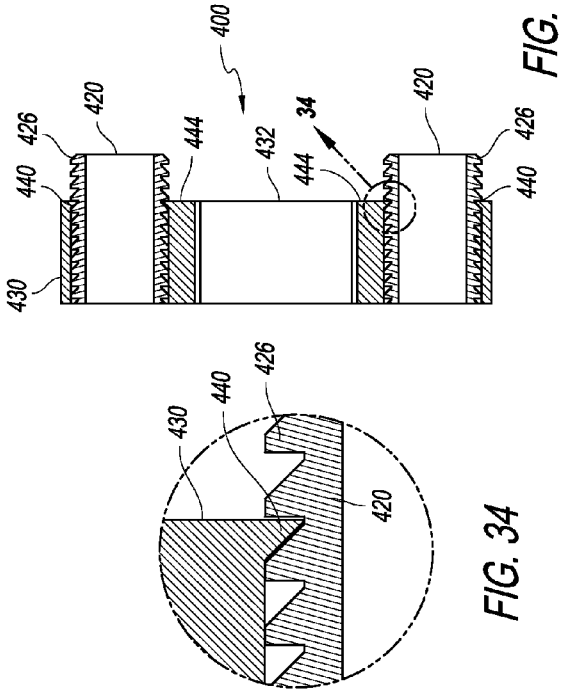
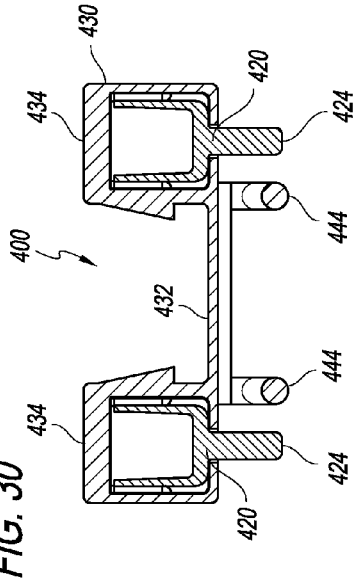


FIG. 33

FIG. 34



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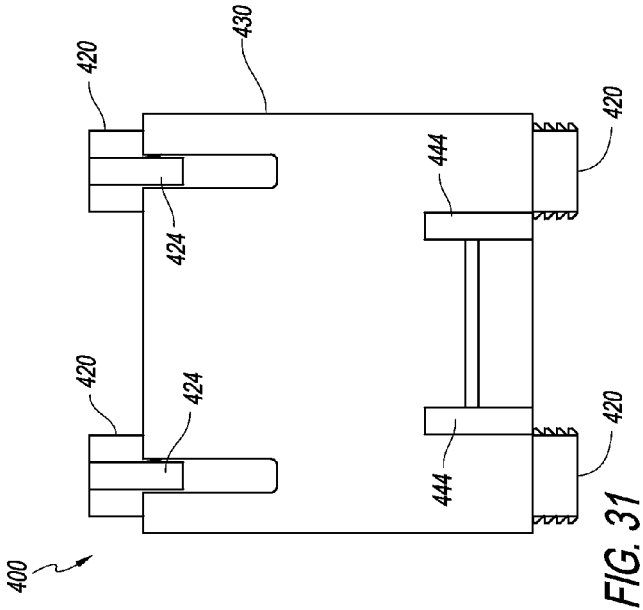

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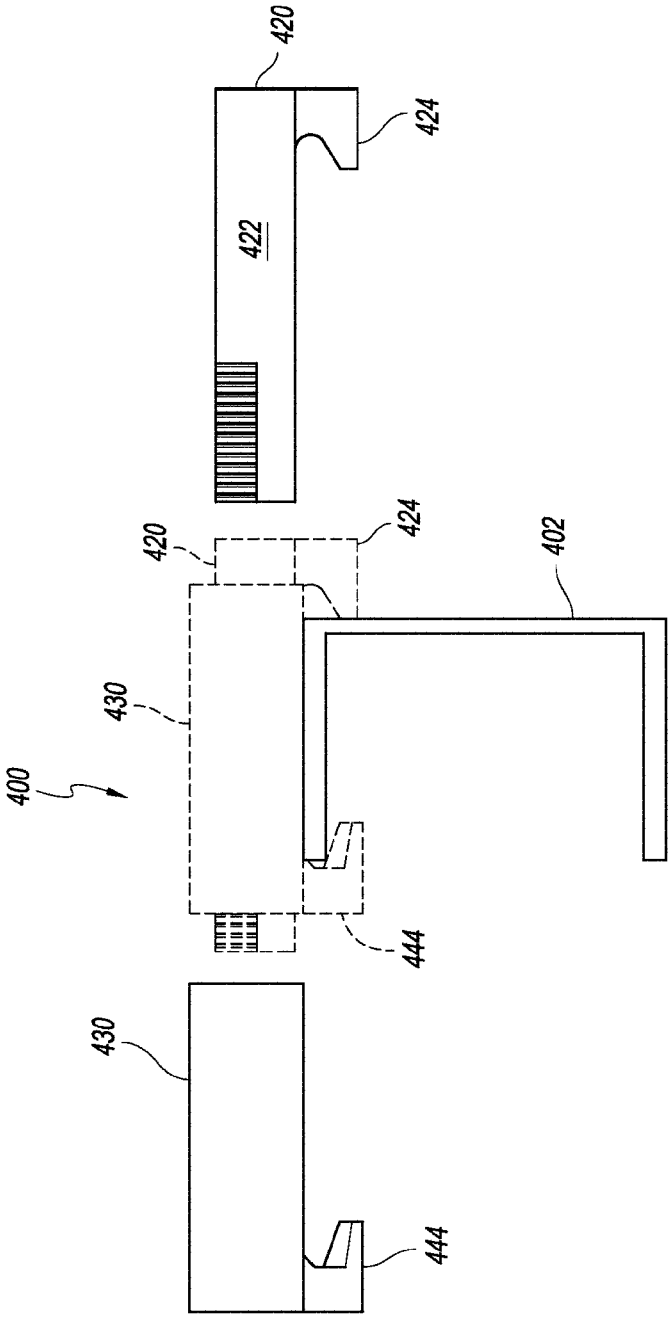

FIG. 35

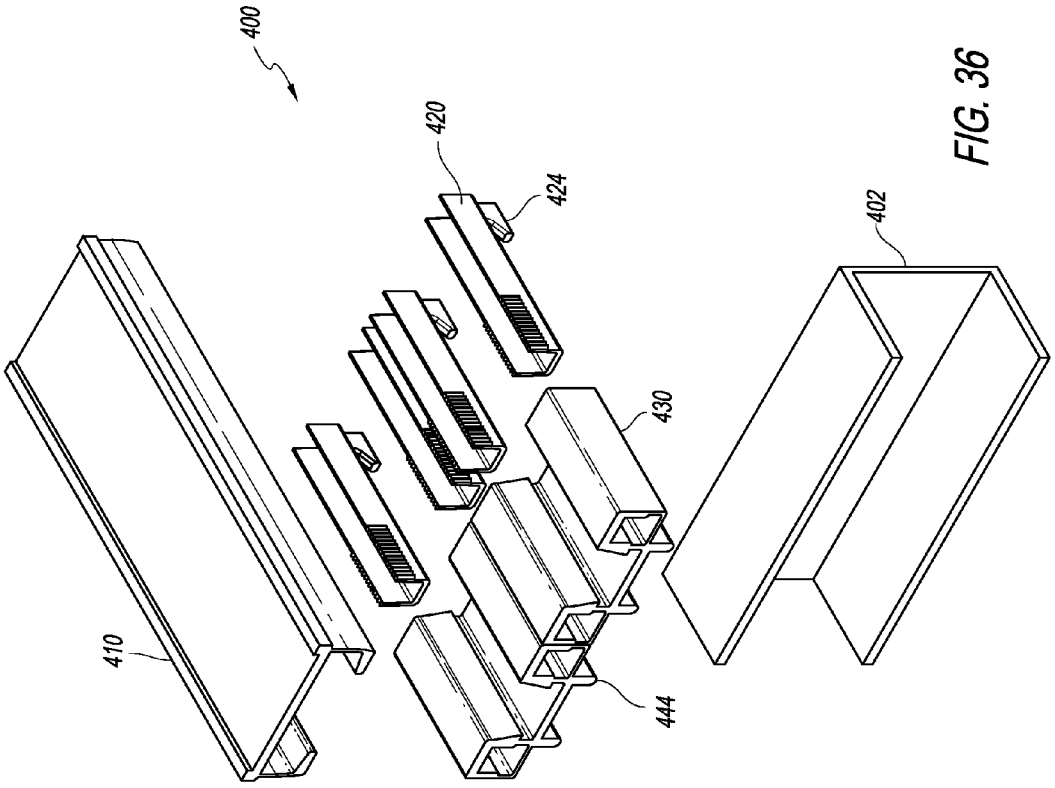

FIG. 36

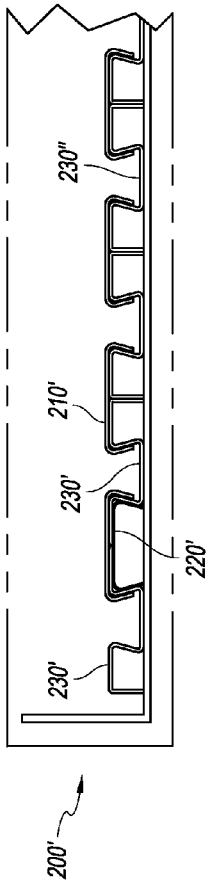

FIG. 38

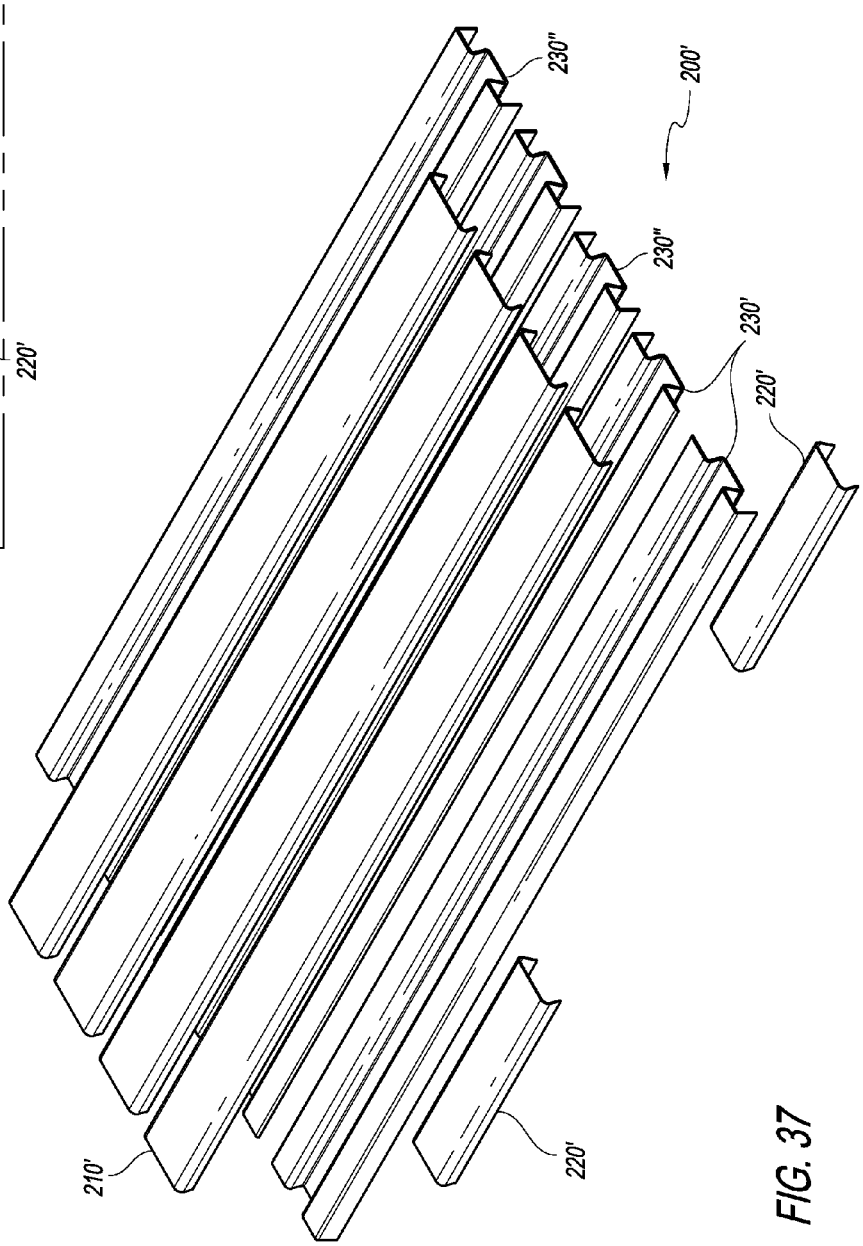

FIG. 37

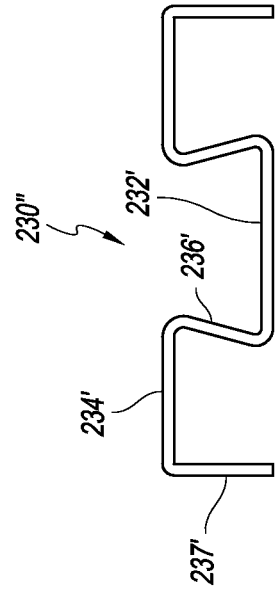

FIG. 41

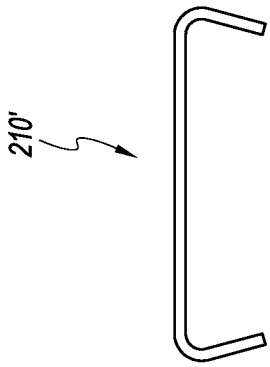

FIG. 42

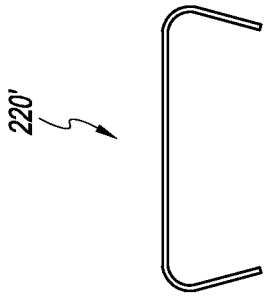

FIG. 39

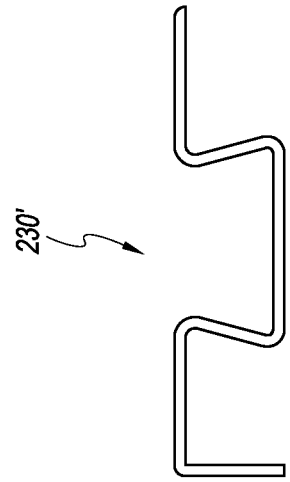

FIG. 40

BEARINGLESS RECIPROCATING SLAT-TYPE CONVEYOR ASSEMBLIES

The present application is a continuation of Patent Cooperation Treaty (PCT) application No. PCT/US2013/031815, filed Mar. 15, 2013. The present application is also a continuation-in-part of U.S. patent application Ser. No. 13/089,307 (now U.S. Pat. No. 8,616,365), filed Apr. 18, 2011; U.S. patent application Ser. No. 13/089,307 (now U.S. Pat. No. 8,616,365) is a continuation-in-part of U.S. patent application Ser. No. 12/332,335 (now U.S. Pat. No. 7,926,646), filed Dec. 10, 2008. The present application is based on and claims priority from these applications, the disclosures of which are hereby expressly incorporated herein by reference.

BACKGROUND OF INVENTION

This invention relates to bearingless reciprocating slat-type conveyor assemblies and, more specifically to a tipper retrofit bearingless reciprocating slat-type conveyor assembly and a snap together bearingless reciprocating slat-type conveyor assembly.

Reciprocating slat-type conveyors (also referred to as "conveyor systems," "live floor conveyors," "reciprocating slat conveyors," or "conveyors") generally include a plurality of elongated slats (also referred to as "conveyor slats," "floor slats," or "deck slats"). The conveyors are generally used in the load-holding compartment of load transport vehicles (e.g. a mobile cargo trailer, bed of a truck (truck bed), rear portion of a semi-trailer, or container portion of a van-truck). The slats are arranged side-by-side to form the floor of the load-holding compartment so that they extend longitudinally to the framework of the load-holding compartment. A "load" may be, for example, grain, fertilizer, soil, sand, shredded documents, chipped wood, sawdust, garbage, or any particulate matter.

The slats are generally grouped such that one group of slats (a group generally includes at least three slats although it is to be understood that each group may include any desired number in excess of two) moves simultaneously in one direction (the "load-conveying direction") and then returns one slat at a time (in the "retraction direction") to the beginning position. This operation results in a step-wise advance of the load positioned on the floor followed by a retraction of the slats without moving the load.

Early live floor conveyors used essentially flat reciprocating slats, such as those described in U.S. Pat. Nos. 3,534,875 and 4,143,760 (which are herein incorporated-by-reference in their entirety). These flat slats rested directly on transverse frame beams and guide beams. This configuration proved problematic because friction between the slats and the beams resulted in great amounts of power lost to friction and the slats not moving smoothly on the beams. This was particularly true when the slats became wet and/or worn.

To alleviate these problems, the industry began using anti-friction bearings between the slats and the beams. This is shown in the pervasive use of bearings in live floor conveyors including, but not limited to those shown in U.S. Pat. Nos. 4,144,963, 4,184,587, 4,611,708, 4,856,645, 5,088,595, 5,165,525, 5,263,573, 5,267,641, 5,301,798, 5,325,957, 5,335,778, 5,547,067, 5,560,472, 5,664,663, 5,727,672, 6,257,396, 6,513,648, 6,651,806, 6,763,933, and 7,152,729 and in U.S. Publication No. 2008/0277246. These references are herein incorporated-by-reference in their entirety. Many of the bearings have a structure similar to that shown in U.S. Pat. No. 4,144,963 (which is herein incorporated-by-reference in its entirety) that describes a plurality of anti-friction bearings made of synthetic thermoplastic resin such as Teflon®, Delrin®, polyethylene, etc., or other suitable material having a low coefficient of friction. Each bearing is substantially U-shape in cross-section, having a top wall and laterally-resilient side walls to overlap the top and sides of a guide beam. Each of the side walls is provided with a pair of downwardly and inwardly extending legs such that, when in position, the legs are positioned inwardly under the opposite sides of the guide beam to secure the bearing against vertical and longitudinal displacement. Bearings, however, can be problematic for many reasons including, but not limited to that they can slip or become worn, they require a large amount of labor to install, they require relatively close tolerances for fitting between the subdeck and slats, they allow road debris such as dust and salt to become entrapped between the deck and the bearing thus increasing wear of the slats, they add weight, and they are expensive to replace.

Live floor conveyors are often used to convey particulate matter. Sometimes it is undesirable to allow the particulate matter to escape the live floor conveyor. For example, shredded confidential paper can not be allowed to escape for legal reasons. Other types of loads such as feeds and fertilizers should not be allowed to filter through the conveyors and onto the ground while the system is in the operating mode. The filtering of chicken feed, for example, to the ground attracts wild birds which in turn can bring disease to flocks of young chickens and other fowl. U.S. Pat. No. 4,727,978 (which is herein incorporated-by-reference in its entirety) is a reciprocating conveyor formed of at least one group of slats of inverted U-shape that are spaced apart laterally. The downward side sections of adjacent slats are positioned within an elongated trough into which the particulate matter is deposited. It should be noted that because the troughs do not support or guide the slats, additional structures such as tubular support members and bearing members must be used.

U.S. Pat. No. 4,611,708 (which is herein incorporated-by-reference in its entirety) is directed to a system that has floor members (slats) that are supported on guide beams with bearing means between the floor members and the guide beams. Channels are formed between the guide beams. Matter such as refrigerated air, small particles of ice, water, and garbage are allowed to enter into the channel space. One problem with this conveyor is that large particles can collect in the channel and remain in the channel after the load has been unloaded. When the particles are confidential documents this problem is not tolerable. When various cargos are being hauled with the same conveyor it is undesirable to mix the cargos. Mixing would occur with this open channel floor. Another problem is that the position of the slat on the guide beam is not very stable. The wide slat is supported only along the length of its center and, therefore, any heavy object sitting offset on the slat can cause the slat to tip on its side and cause uneven wear.

U.S. Pat. No. 5,727,672 (which is herein incorporated-by-reference in its entirety) is directed to a system that uses four primary components: pultruded conveyor slats, bearings, guide members, and support members. The slats have downwardly directed lower sections that grip the guide members. The slats also have wing portions that are supported by the bearings that are, in turn, supported by the support members. The bearings also act as a seal to prevent particulate matter from escaping. If, however, particulate matter gets past the bearing seal, it will escape the conveyor

system. Since the pathway for material to escape has a horizontal portion and a downward portion it is natural for material to leak. In other words, there is little resistance to leakage except for the weight of the load on the slat on the seal. Also, there is little to prevent material from entering the sliding contact area between the bearing and the slat. When particles enter this joint they reduce the effectiveness of the bearing and cause premature wear.

U.S. Pat. No. 6,257,396 (which is herein incorporated-by-reference in its entirety) is directed to a system that uses three primary components: slats, bearing strips (having a longitudinal groove on the top surface thereof), and longitudinal beams. The longitudinal beams are shaped like channels. The bearing strips are supported on the longitudinal beams, but completely enclose the interior of the channels. The slats are longitudinally supported on two adjacent bearing strips and longitudinal beams. This reference states that particulate matter that filters between the edges of the adjoining slats falls into the grooves in the bearing strips and is cleared away during the conveying process and/or routine maintenance. If, however, particulate matter gets past the bearing strip, it will escape the conveyor system. In addition, the pathway for material to escape the cargo area and enter the contact area between the slat and the bearing is down and horizontal. There is little resistance to prevent material from entering the sliding contact area and thereby cause greater resistance to the sliding motion. Finally, the slat must have a stiff cross-section to resist buckling since the joint between the subdeck and the deck is very loose.

U.S. Pat. No. 6,513,648 (which is herein incorporated-by-reference in its entirety) is directed to a system that uses three primary components: elongated subdeck sections (which are joined together by liquid-tight seals) with upwardly projecting bearing supports, elongated bearings that wrap around the upwardly projecting bearing supports, and deck slats. If this system is functioning properly, it can be extremely effective and even liquid tight. However, if the seals fail or are not installed properly, there may be at least some places where particulate matter can escape from the conveyor system. In addition, the pathway for material to escape the cargo area and enter the contact area between the slat and the bearing is down and horizontal. There is little resistance to prevent material from entering the sliding contact area and thereby cause greater resistance to the sliding motion. The increased friction also occasionally causes the bearing to slide off the bearing posts.

There are many trailers produced whose sole function is to be loaded through the open ceiling of the trailer with municipal waste, driven to a landfill, and loaded onto a tipping platform and tipped to great heights to dump the load of waste out the rear door (gate). These trailers are most often called "tipper trailers." Exemplary tipper trailers are shown and discussed in U.S. Pat. No. 6,019,568 to Bratlie, U.S. Pat. No. 6,860,695 to Chapman et al., and U.S. Pat. No. 7,100,972 to Booher. These references are herein expressly incorporated by reference in their entirety.

BRIEF SUMMARY OF THE INVENTION

Described herein are reciprocating slat-type conveyors, and more particularly bearingless, reciprocating slat-type conveyors in which the longitudinal edges of the slats are supported by guide trough subdecks. Also described herein is a tipper retrofit bearingless reciprocating slat-type conveyor assembly and a snap together bearingless reciprocating slat-type conveyor assembly.

Described herein is a reciprocating slat conveyor for use in a load-holding compartment, the reciprocating slat conveyor including: a plurality of elongate hold down strips, a plurality of elongate guide trough subdecks, and a plurality of longitudinal slats adjacent to and parallel to each other. Each hold down strip has subdeck engaging structure. Each elongate guide trough subdeck has an elongate span between elongate slat supports, each elongate guide trough subdeck has slat engaging structure, and at least one elongate slat support has hold down strip engaging structure. Each slat has a plurality of substantially downwardly projecting legs, each leg has subdeck engaging structure. The plurality of elongate hold down strips are laterally spaced and substantially parallel on a floor of the load-holding compartment, the hold down strip engaging structure engaging the subdeck engaging structure, and the slat engaging structure engaging the subdeck engaging structure to allow longitudinal movement of the longitudinal slats.

The plurality of elongate guide trough subdecks are preferably made of a first material, the plurality of longitudinal slats are preferably made of a second material dissimilar to the first material. The first material may be stiffer than the second material.

The conveyor is preferably free from distinct bearing elements between the subdecks and the slats.

The plurality of elongate hold down strips may have a longitudinal base and upward longitudinal fingers on either side thereof. In such a case, the subdeck engaging structure might include longitudinal barbs projecting outwardly from each longitudinal finger; the slat engaging structure might project towards the elongate span from an outside elongate side surface of each elongate slat support, the hold down strip engaging structure projecting inward from an inside surface of the elongate slat support; and the subdeck engaging structure might be an inwardly projecting longitudinal subdeck engaging structure.

The load-holding compartment may be a tipper trailer and the reciprocating slat-type conveyor may be a lightweight and quickly installable reciprocating slat conveyor.

Described herein is a reciprocating slat conveyor for use in a load-holding compartment having at least cross-member has an overhang. The reciprocating conveyor preferably includes at least one reciprocating slat-type conveyor assembly and at least one elongate slat at least partially supported by the at least one subdeck. The at least one reciprocating slat-type conveyor assembly preferably includes at least one anchor having at least one upper anchor subdeck engager and at least one lower anchor cross-member engager. The at least one reciprocating slat-type conveyor assembly also preferably includes at least one subdeck having at least one upper subdeck anchor-slat engager and at least one lower subdeck cross-member engager. When the at least one anchor subdeck engager and the at least one subdeck anchor-slat engager are engaged, the at least one anchor cross-member engager and the at least one subdeck cross-member engager engage the cross-member.

Preferably, the at least one upper anchor subdeck engager includes at least one anchor trough and the at least one lower anchor cross-member engager includes at least one anchor hook.

Preferably, the at least one upper subdeck anchor-slat engager includes at least one slat support and the at least one lower subdeck cross-member engager includes at least one subdeck hook.

Preferably, the at least one upper anchor subdeck engager is an anchor trough and the at least one lower anchor cross-member engager is an anchor hook, the at least one

upper subdeck anchor-slat engager being a pair of slat supports separated by a subdeck span and the at least one lower subdeck cross-member engager is a pair of subdeck hooks.

Preferably, the at least one anchor subdeck engager is insertable into the at least one subdeck anchor-slat engager.

Preferably, the at least one anchor subdeck engager has anchor interlocking structure and the at least one subdeck anchor-slat engager has subdeck interlocking structure. The anchor interlocking structure and the subdeck interlocking structure to interlock the at least one anchor in relation to the at least one subdeck.

Preferably, the at least one anchor cross-member engager is at least one anchor hook and the at least one subdeck cross-member engager is at least one subdeck hook. At least part of one of the at least one anchor hook and the at least one subdeck hook may be positioned below the overhang of the cross-member to prevent vertical movement of the at least one reciprocating slat-type conveyor assembly in relation to the cross-member.

Preferably, the installation of the at least one reciprocating slat-type conveyor assembly does not damage the cross-member.

Preferably, the conveyor is free from distinct bearing elements between the subdecks and the slats.

Preferably, the subdecks are made of a first material and the slats are made of a second material dissimilar to the first material. Preferably, the first material being stiffer than the second material.

One preferred embodiment reciprocating slat conveyor includes a plurality of laterally and substantially parallel longitudinal trough-like subdecks and a plurality of longitudinal slats adjacent to and parallel to each other. Each slat has a slat top surface, a slat bottom surface, a slat first longitudinal side edge, and a slat second longitudinal side edge. Each slat centrally located within the load-holding compartment is in a sliding relationship with a pair of adjacent subdecks and covers the longitudinal space between the pair of adjacent subdecks, the pair of adjacent subdecks conducting the movement of the slat. Each subdeck centrally located within the load-holding compartment longitudinally supports two adjacent slats at or near a slat longitudinal side edge.

The subdecks are preferably in a spaced relationship so as to form a longitudinal space between adjacent subdecks. In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, drive mechanisms are positioned in the longitudinal spaces between adjacent subdecks.

In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, the subdecks are made of a first material and the slats are made of a second material dissimilar to the first material. In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, the first material is stiffer than the second material.

In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, the reciprocating slat conveyor is free from distinct bearing elements between the subdecks and the slats.

In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, first seals are formed when the slat first longitudinal side edge of one slat is in sliding relationship with the slat second longitudinal side edge of an adjacent slat. In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, the slat first longitudinal side edge of one slat overlaps with the slat second longitudinal side edge of an adjacent slat.

In some preferred double-sealed, bearingless, reciprocating slat-type conveyors, second seals are formed when upward side projections and/or slat engagers of the subdeck are substantially coextensive and in sliding relationship with the slat surfaces (e.g. the slat bottom surface or legs extending downwardly from the slat).

Also disclosed herein is a reciprocating slat conveyor for use in a load-holding compartment. The reciprocating conveyor includes a plurality of subdecks and a plurality of slats. The plurality of subdecks is laterally and substantially parallel to each other and to longitudinal subdecks made of a first material. The plurality of slats is longitudinal slats adjacent to and parallel to each other. The slats are made of a second material dissimilar to the first material. The conveyor is free from distinct bearing elements between the subdecks and the slats. The first material may be stiffer than the second material. The second material may be stiffer than the first material.

The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate various exemplary embodiments.

FIG. **1** is a perspective view of a plurality of deck slats moving simultaneously in a "load-conveying direction."

FIG. **2** is a perspective view of a plurality of deck slats, one slat from each group moving in a "retraction direction" opposite the "load-conveying direction."

FIG. **3** is a perspective top view of a load-holding compartment of a load transport vehicle with a plurality of deck slats removed to show exemplary systems and structures of a hydraulically-powered conveyor system.

FIG. **4** is a perspective top view of a load-holding compartment of a load transport vehicle with a plurality of deck slats removed to show exemplary substructures of a reciprocating slat-type conveyor such as cross-drives and cross-drive shoes.

FIG. **5** is a perspective view of a section of the deck slats, subdecks, and exemplary substructure of a reciprocating slat-type conveyor of the present invention.

FIG. **6** is a longitudinal side cross-sectional view of a load-holding compartment of a load transport vehicle showing a deck slat, subdeck, and exemplary substructure of a reciprocating slat-type conveyor of the present invention.

FIG. **7** is a cross-sectional view of a section of the floor including deck slats, subdecks, and cross-drive shoes of a reciprocating slat-type conveyor of the present invention taken along a section of the floor with cross-drive shoes.

FIG. **8** is a cross-sectional view of a section of the floor including deck slats and subdecks of a reciprocating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **9** is a cross-sectional view of a section of an alternative preferred embodiment of a floor including first alternative deck slats and subdecks of a reciprocating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **10** is a cross-sectional view of a section of an alternative preferred embodiment of a floor including second alternative deck slats and alternative subdecks of a recipro-

cating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **11** is a cross-sectional view of a section of an alternative preferred embodiment of a floor including third alternative deck slats and alternative subdecks of a reciprocating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **12** is a cross-sectional view of a section of an alternative preferred embodiment of a floor including fourth alternative deck slats and alternative subdecks of a reciprocating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **13** is a cross-sectional view of a section of an alternative preferred embodiment of a floor including fifth alternative deck slats and alternative subdecks of a reciprocating slat-type conveyor of the present invention taken along a section of the floor without cross-drive shoes.

FIG. **14** is a cross-sectional view of a section of a tipper retrofit reciprocating slat-type conveyor assembly that may be used for converting a tipper trailer.

FIG. **15** is a cross-sectional view of a section of a hold down strip of the tipper retrofit reciprocating slat-type conveyor of FIG. **14**.

FIG. **16** is a cross-sectional view of a section of a subdeck of the tipper retrofit reciprocating slat-type conveyor of FIG. **14**.

FIG. **17** is a perspective view of a load-holding compartment having a snap together reciprocating slat-type conveyor assembly (shown as a first exemplary snap together reciprocating slat-type conveyor assembly), the assembly having some of the slats removed to show the cross-members.

FIG. **18** is an exploded perspective view of anchors and a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly.

FIG. **19** is a cross-sectional view of anchors, subdecks, and slats of the first exemplary snap together reciprocating slat-type conveyor assembly, showing a maximum gap between the slats when installed on a cross-member.

FIG. **20** is a cross-sectional view of anchors, subdecks, and slats of the first exemplary snap together reciprocating slat-type conveyor assembly, showing a minimum gap between the slats when installed on a cross-member.

FIG. **21** is an end view of anchors and a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **22** is a bottom view of anchors and a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **23** is a side view of anchors and a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **24** is an enlarged cross-sectional view of the ends of anchors joined to a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly, showing the interlocking barbs engaging the interlocking projections.

FIG. **25** is a side view of anchors and a subdeck of the first exemplary snap together reciprocating slat-type conveyor assembly being installed, the installed position being depicted in phantom.

FIG. **26** is a perspective expanded view of anchors, subdecks, and a slat of the first exemplary snap together reciprocating slat-type conveyor assembly.

FIG. **27** is an exploded perspective view of anchors and a subdeck of a second exemplary snap together reciprocating slat-type conveyor assembly.

FIG. **28** is a cross-sectional view of anchors, subdecks, and slats of the second exemplary snap together reciprocating slat-type conveyor assembly, showing a maximum gap between the slats when installed on a cross-member.

FIG. **29** is a cross-sectional view of anchors, subdecks, and slats of the second exemplary snap together reciprocating slat-type conveyor assembly, showing a minimum gap between the slats when installed on a cross-member.

FIG. **30** is an end view of anchors and a subdeck of the second exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **31** is a bottom view of anchors and a subdeck of the second exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **32** is a side view of anchors and a subdeck of the second exemplary snap together reciprocating slat-type conveyor assembly, the anchors and a subdeck being joined together.

FIG. **33** is an enlarged cross-sectional view of the ends of anchors joined to a subdeck of the second exemplary snap together reciprocating slat-type conveyor assembly, showing the interlocking barbs engaging the interlocking projections.

FIG. **34** is an enlarged cross-sectional view of the interlocking barbs engaging an interlocking projection.

FIG. **35** is a side view of anchors and a subdeck of the second exemplary snap together reciprocating slat-type conveyor assembly being installed, the installed position being depicted in phantom.

FIG. **36** is a perspective expanded view of anchors, subdecks, and a slat of the second exemplary snap together reciprocating slat-type conveyor assembly.

FIG. **37** is a exploded view of a section of an alternative tipper retrofit reciprocating slat-type conveyor assembly that may be used for converting a tipper trailer.

FIG. **38** is a cross-sectional view of a section of a hold down strip of the tipper retrofit reciprocating slat-type conveyor of FIG. **37**.

FIG. **39** is a cross-sectional view of section of a hold down strip of the tipper retrofit reciprocating slat-type conveyor of FIG. **37**.

FIG. **40** is a cross-sectional view of a section of a subdeck (bearing/guide) of the tipper retrofit reciprocating slat-type conveyor of FIG. **37**, the subdeck (bearing/guide) modified to accept the hold down.

FIG. **41** is a cross-sectional view of a section of an unmodified subdeck (bearing/guide) of the tipper retrofit reciprocating slat-type conveyor of FIG. **37**.

FIG. **42** is a cross-sectional view of a section of a slat of the tipper retrofit reciprocating slat-type conveyor of FIG. **37**.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1-13** are generally directed to the basic concepts of a reciprocating conveyor and/or features of a double-sealed, bearingless, reciprocating conveyor with slat-supporting guide trough subdecks. FIGS. **14-16** and **37-42** are directed to tipper retrofit bearingless reciprocating slat-type conveyor assemblies. FIGS. **17-36** are directed to snap together bearingless reciprocating slat-type conveyor assemblies.

Before describing the double-sealed, bearingless, reciprocating conveyor with slat-supporting guide trough subdecks of the present invention, some of the basic concepts of a reciprocating conveyor are discussed. Please note that the terms and phrases may have additional definitions and/or examples throughout the specification. Where otherwise not specifically defined, words and phrases are given their ordinary meaning in the art. Exemplary embodiments may be better understood with reference to the drawings, but these embodiments are not intended to be of a limiting nature. The same reference numbers will be used throughout the drawings and description in this document to refer to the same or like parts.

As shown in FIGS. **1-3**, reciprocating slat-type conveyors **10** (also referred to as "conveyor systems," "live floor conveyors," "reciprocating slat conveyors," or "conveyors") generally include a plurality of elongated slats **20***a*, **20***b*, **20***c* (also referred to as "conveyor slats," "floor slats," or "deck slats" and referenced generally by reference number **20** in FIGS. **5-8**). Conveyor systems **10** are generally used in the load-holding compartment **12** of load transport vehicles. Exemplary load-holding compartments **12** include a mobile cargo trailer, a bed of a truck (truck bed), a rear portion of a semi-trailer, a cargo container, a container portion of a van-truck, stationary bins, or any mobile or stationary load holder. The load-holding compartments **12** have a framework that has a longitudinal direction and a transverse direction perpendicular to the longitudinal direction. Although the longitudinal direction is generally longer than the transverse direction, these terms are not meant to be so limited. In FIGS. **3** and **4**, the longitudinal direction is shown as extending from the front **14** (with the bulkhead **14***a*, the slope sheet **14***b*, and the slope sheet wiper **14***c*) to the rear **16**. The slats **20** (also referred to as **20***a*, **20***b*, **20***c*) are arranged side-by-side to form the floor of the load-holding compartment **12** so that they extend parallel to the longitudinal direction of the framework of the load-holding compartment **12**. The design of the slats **20**, including length, width, and thickness, depends upon factors including the dimensions of the floor, the construction material, and the application(s) for which the conveyor is to be used.

In one preferred double-sealed, bearingless, reciprocating slat-type conveyor, the slats **20** are arranged in groups of slats (a group generally includes at least three slats **20***a*, **20***b*, **20***c*, although it is to be understood that each group may include any desired number in excess of two). As shown in FIG. **1**, the slats **20***a*, **20***b*, **20***c* move simultaneously in one direction (the "load-conveying direction"). Then, as shown in FIG. **2**, one slat **20***a* of each group moves in the opposite direction (the "retraction direction"), followed by another slat **20***b* of each group, and so on until all the slats of the groups are retracted. In this double-sealed, bearingless, reciprocating slat-type conveyor, the slats **20** move together taking the load with them, and then the slats **20** return to their starting position, with every third slat **20***a*, **20***b*, **20***c* moving in unison. The stationary slats (those not currently returning) hold the load at least partially in place until the next cycle begins. This operation results in a step-wise advance (in the load-conveying direction) of particulate matter positioned on the floor that may be followed by partial retraction of the particulate matter on the floor. It should be noted that alternative double-sealed, bearingless, reciprocating slat-type conveyors may use alternative slat sequences shown and described in any of the references that are incorporated-by-reference herein. (For example, some of the references describe sequences in which a majority of the slats may be moved simultaneously in the load-conveying direction while the remaining slats are moved in the opposite, retraction direction.) It should be noted that the present invention is not to be limited to double-sealed, bearingless, reciprocating slat-type conveyors using these specific slat sequences.

Exemplary double-sealed, bearingless, reciprocating slat-type conveyors include hydraulically-powered conveyor systems such as that shown in FIG. **3**. In this shown double-sealed, bearingless, reciprocating slat-type conveyor, a two-way, variable-speed, hydraulic power unit **40** moves the floor and allows for controlled loading, unloading, and precision metering. The size and location of the power unit **40** depends upon the application(s) of the conveyor system. Alternative double-sealed, bearingless, reciprocating slat-type conveyors may be powered using power units and structures shown and described in any of the references that are incorporated-by-reference herein. It should be noted that the present invention is not to be limited to double-sealed, bearingless, reciprocating slat-type conveyors powered using these power units **40** and structures.

FIG. **4** is a perspective top view of a section of subdecks **30** and other exemplary substructures **42**, **44**, **46** used to support the slats or physically connect the power system (including the power unit **40**) to the slats **20**. The subdecks **30** will be discussed in detail herein. Other exemplary substructures shown in this figure includes cross-members **42**, cross-drives **44**, and cross-drive shoes **46**. The cross-drive shoes **46** can also be considered to be part of the drive mechanism along with the power unit **40** and any structure (e.g. the cross-drives **44**) connecting the cross-drive shoes **46** to the power unit **40**. Alternative double-sealed, bearingless, reciprocating slat-type conveyors may use alternative substructure and drive mechanisms such as that shown and described in any of the references that are incorporated-by-reference herein. It should be noted that the present invention is not to be limited to these embodiments of the substructure and drive mechanisms.

Deck Slats and Subdecks

As will be discussed in more detail, the present invention includes a plurality of laterally and substantially parallel longitudinal trough-like subdecks **30** that are in a spaced relation so as to define a longitudinal opening or space **31** between adjacent subdecks **30**. A plurality of longitudinal slats **20** are adjacent to and parallel to each other and, in preferred embodiments, are overlapping. Each slat **20** centrally located within the load-holding compartment **12** (as opposed to those slats on the longitudinal edges of the load-holding compartment **12**—e.g. in some embodiments there is one on the right edge and one on the left edge) are in a sliding relationship with two adjacent subdecks **30**. The slats **20** substantially cover the longitudinal space **31** between the two adjacent subdecks **30**. Each subdeck **30** centrally located within the load-holding compartment **12** (as opposed to those subdecks on the longitudinal edges of the load-holding compartment **12**—e.g. in some embodiments there is one on the right edge and one on the left edge) longitudinally supports two adjacent slats **20**. In preferred embodiments, there is a raised double-seal system protecting the channel formed by the trough-like subdecks **30**. The first seal **48***a* is formed when the slat first longitudinal side edge of one slat is substantially coextensive and in sliding relationship with the slat second longitudinal side edge of an adjacent slat (e.g. by overlapping the slats **20**). The second seal **48***b* is formed when upward side projections of the subdeck are substantially coextensive and in sliding relationship with the bottom surface of the slats supported by the upward side projections (e.g. between the slats **20** and the

subdecks **30** such that the seal **48***b* is raised to be near the bottom surface of the slats **20**).

FIGS. **5-8** show the deck slats **20**, slat-supporting guide trough subdecks **30**, and exemplary substructure (e.g. the cross-drive shoes **46**) of a double-sealed, bearingless, reciprocating conveyor system **10** of the present invention. In preferred embodiments of the present invention, the deck slats **20** and subdecks **30** are made from dissimilar materials. This is one of the means by which the present invention is able to function without bearings between the deck slats **20** and subdecks **30**. Either the slats **20** or the subdecks **30** may be constructed of a light-weight material that is not stiff enough to prevent buckling due to longitudinal forces and/or other forces. The other component is constructed from an adequately stiff material that is capable of preventing this buckling. In the preferred embodiments, the deck slats **20** are constructed of an anti-friction material such as Extruded High Density Polyethelene (EHDP), High-Density Polyethylene (HDPE), Polyethylene High-Density (PEND), synthetic thermoplastic resin (e.g. Teflon®, Delrin®, polyethylene), UHMW plastic (high molecular weight resinous material), or other suitable material having a low coefficient of friction that is known or yet to be developed. The slats **20** may be made using processes such as continuous or discontinuous extrusion, pultrusion, molding, and other processes known or yet to be developed. It should be noted that, in preferred embodiments, each slat **20** is an integrally formed single piece (e.g. the legs are integral with the rest of the slat). Hallco Industries, Inc. of Tillamook, Oreg. manufactures slats (Part No. 39-5023) that may be purchased individually or as a set. In the shown embodiments, the subdecks **30** are constructed of a strong, stiff material such as steel, aluminum, or other suitable material that is stiffer than the slat material and that creates a low friction joint with the slat, the material being known or yet to be developed. The subdecks **30** may be made using processes such as hot or cold roll forming, extrusion, or cold drawing, and other processes known or yet to be developed. It should be noted that, in preferred embodiments, each subdeck **30** is an integrally formed single piece (e.g. the upward projections and slat engagers are integral with the rest of the subdeck). The dimensions shown in the figures and described herein are meant to be exemplary and are not meant to limit the scope of the invention. Depending on the material used, the dimensions, and other relevant factors, a conveyor system **10** of the present invention may hold a maximum load of 15,000 pounds (6,810 kilograms) to 20,000 pounds (9,080 kilograms) and may have a maximum longitudinal length of 20 feet (6 meters) to 25 feet (7.6 meters).

FIGS. **7** and **8** show a preferred exemplary embodiment of the deck slats **20**. The slats have a front end (positioned substantially near the front **14** of the load handling compartment **12**, less a clearance), a rear end (positioned substantially near the rear **16** of the load handling compartment **12**, less a clearance), a top surface **22***a* (also referred to as the upper load-bearing surface **22***a*), a bottom surface **22***b* (also referred to as the lower surface **22***b*), a first longitudinal side edge **24***a*, and a second longitudinal side edge **24***b*. Extending downward from the slat bottom surface **22***b* are a pair of legs **26***a*, **26***b*, one leg **26***a*, **26***b* at or near each side edge **24***a*, **24***b*. In the shown embodiment, the slat legs **26***a*, **26***b*, are inwardly directed L-shaped legs that will engage the subdeck **30**. The slat side edges **24***a*, **24***b* are designed to be substantially coextensive and in sliding relationship with adjacent slat side edges **24***a*, **24***b* such as by overlapping or using a shiplap-type configuration. In the shown embodiment of FIGS. **1-8**, there is a raised sealing longitudinal projection **28** extending along, but slightly above, the first longitudinal side edge **24***a* of each slat **20**. The raised sealing longitudinal projection **28** has a bottom surface that engages (mates with and provides a substantial seal thereto) the slat top surface **22***a* of the adjacent slat second longitudinal side edge **24***b* to form the seal **48***a*. If, as shown, the legs **26***a*, **26***b* are slightly inward from their respective side edges **24***a*, **24***b*, the slat **20** has outwardly extending protrusions beyond the legs **26***a*, **26***b*. In the shown embodiment, the raised sealing longitudinal projection **28** is mounted on or integral with the outwardly extending protrusion on the first longitudinal side edge **24***a* of each slat and the bottom surface of the longitudinal projection **28** engages the slat top surface **22***a* of the outwardly extending protrusion on the adjacent slat second longitudinal side edge **24***b*. The seal **48***a* formed by the overlapping slats **20** prevents debris and particulate matter from escaping the conveyor system **10** by providing floor-length protection. Because these slat surfaces have a low friction coefficient, the slats **20** are able to move relative to each other.

FIGS. **7** and **8** show a preferred exemplary embodiment of the slat-supporting guide trough subdecks **30**. This adjective-laden term is meant to highlight several features of the subdecks **30**. First, the subdecks **30** support the slats **20** longitudinally along their longitudinal edges **24***a*, **24***b*. Second, the subdecks **30** act as a guide or guide beam that conducts the movement of the slats **20**. Third, the subdecks **30** are shaped at least partially like a longitudinal trough or channel (substantially U-shaped with a base and two upwardly extending projections) that is able to catch and contain any debris and particulate matter that passes through the overlapping slats **20** from escaping the conveyor system **10**. The subdecks have a front end (positioned substantially near the front **14** of the load handling compartment **12**, less a clearance), a rear end (positioned substantially near the rear **16** of the load handling compartment **12**, less a clearance), an interior surface **32***a*, an exterior surface **32***b*, a first longitudinal side edge **34***a* (also referred to as the first upward side projection **34***a*), and a second longitudinal side edge **34***b* (also referred to as the second upward side projection **34***b*). In the preferred embodiment, the top of the upward side projections **34***a*, **34***b* are slat engagers **36***a*, **36***b*. In the shown embodiment, the slat engagers **36***a*, **36***b* and the upward side projections **34***a*, **34***b* together form a substantially T-shape upward projection from the base. It should be noted that the slat engagers **36***a*, **36***b* may have an alternative shape and they may be part of and/or integral with the upward side projections **34***a*, **34***b*. The top surfaces of the slat engagers **36***a*, **36***b* engage the bottom surface **22***b* of the slats **20**. The inwardly projecting portions (the part towards the interior of the subdeck) of the slat engagers **36***a*, **36***b* engage the slat legs **26***a*, **26***b*. As shown, this configuration would substantially prevent vertical (up-down) movement between the slats **20** and their supporting subdecks **30**, but would allow substantially free longitudinal movement (sliding contact) between the slats **20** and their supporting subdecks **30**. The shapes of these features also help to keep load particulate matter from getting into the sliding joints between the slats **20** and the subdecks **30**. If there is enough load contained in the channel to lift the slats enough to allow particulate matter into the sliding joint, the slat legs **26***a*, **26***b* (the "L-shaped portion") makes contact with the lower surface of the subdeck slat engagers **36***a*, **36***b* and thus creates a stronger seal **48***b* to prevent the passage of the load matter. Because the surfaces of the slats **20** have a low friction coefficient and because the materials from which the

slats **20** and the subdecks **30** are constructed are dissimilar, there is no need for a bearing therebetween.

In preferred embodiments, as shown in FIGS. **1** and **6**, end caps **50** may be positioned and secured at the ends of the subdecks **30** near the rear **16** of the load handling compartment **12**. The end caps **50** plug the hole between the subdeck and the rear sill of the container (FIG. **4**) to prevent load from escaping. A similar arrangement could be placed at the front end **14** for a really secure container although the wiper **14***c* and slope sheet **14***b* are designed to prevent load from entering the front portion of the deck.

FIGS. **9-13** show alternative preferred embodiments of the slats and subdecks. These embodiments share many of the characteristics of the preferred embodiment shown in FIGS. **1-8**. Another alternative preferred embodiment would contain slats that have longitudinal edges with a true shiplap design. It should be noted that these alternative preferred embodiments may include additional patentable features.

FIG. **9** shows an alternative slat **70** embodiment with a sealing longitudinal projection **72** at or near the slat first longitudinal side edge and with a longitudinal notch **74** near the slat second longitudinal side edge. The sealing longitudinal projection **72** is substantially level with the top surface of the slat **70**. Sealing longitudinal projections **72** mate with respective longitudinal notches **74** of adjacent slats **70** to form a substantial seal therewith. The resulting connection between the sealing longitudinal projections **72** and adjacent longitudinal notches **74** has no surfaces higher than the top surface of the slat **70**.

FIG. **10** shows an alternative slat **80** embodiment with inwardly directed longitudinal L-shaped legs **82***a*, **82***b* at the slat longitudinal side edges of the slat **80**. The first L-shaped leg **82***a* has a sealing longitudinal projection **84** extending substantially perpendicular thereto. The second L-shaped leg **82***b* has a notch **86** defined therein designed to mate with the sealing longitudinal projection **84**. Sealing longitudinal projections **84** mate with respective longitudinal notches **86** of adjacent slats **80** to form a substantial seal therewith. The resulting connection between the sealing longitudinal projections **84** and adjacent longitudinal notches **86** makes the floor formed from the top surfaces of the slats **80** substantially flat.

FIG. **11** shows an alternative slat **88** embodiment in which the slat longitudinal side edges **89***a*, **89***b* are angled or otherwise formed to be in mating relationship. The resulting connection between the longitudinal side edges **89***a*, **89***b* makes the floor formed from the top surfaces of the slats **88** substantially flat.

FIG. **12** shows an alternative slat **90** embodiment with inwardly directed longitudinal L-shaped legs **92***a*, **92***b* near the slat longitudinal side edges of the slat **90**. The first L-shaped leg **92***a* has an upwardly-angled sealing longitudinal projection **94** therefrom. In this shown embodiment, the upwardly-angled sealing longitudinal projection **94** mates with the intersection of the top of the slat **90** and the second L-shaped leg **92***b*. Sealing longitudinal projections **94** mate with respective longitudinal notches **96** of adjacent slats **90** to form a substantial seal therewith. The resulting connection between the sealing longitudinal projections **94** and adjacent longitudinal notches **96** makes the floor formed from the top surfaces of the slats **90** substantially flat.

FIG. **13** shows an alternative slat **96** embodiment with inwardly directed longitudinal upside-down T-shaped legs **98***a*, **98***b* near the slat longitudinal side edges of the slat **96**. In this embodiment, rather than using an integral longitudinal projection, a distinct longitudinal sealing member **99** (shown as a solid bar) is used. In this shown embodiment, the longitudinal sealing member **99** mates with the outwardly directed portions of the T-shaped legs **98***a*, **98***b* to form a substantial seal therewith. The resulting connection between the longitudinal sealing member **99** and the outwardly directed portions of the T-shaped legs **98***a*, **98***b* makes the floor formed from the top surfaces of the slats **96** substantially flat.

FIGS. **10-13** also show an alternative preferred embodiment of the subdeck **100**. Like the subdecks **30**, alternative subdecks **100** have a front end (positioned substantially near the front **14** of the load handling compartment **12**, less a clearance), a rear end (positioned substantially near the rear **16** of the load handling compartment **12**, less a clearance), an interior surface, and an exterior surface. The first longitudinal side edge **104***a* (also referred to as the first upward side projection **104***a*) and the second longitudinal side edge **104***b* (also referred to as the second upward side projection **104***b*) are preferably upside-down, inwardly-directed L-shaped members. As shown, the "L" of the side projections **104***a*, **104***b* engages the bottom surface of the slats.

Advantages and Features of the Double-Sealed, Bearingless, Reciprocating Slat-Type Conveyor Described Herein

The simple and elegant use of materials and design in the present invention belies the revolutionary nature of the present invention. Although reciprocating conveyors have been produced since at least 1970, they continue to have problems such as those described in the Background of this specification. Although various known reciprocating conveyors solve some of the problems, most continue to have at least some of the problems. Also, sometimes the solutions result in additional complexity, expense, weight, installation time, and/or other undesired consequences. The present invention is a complete redesign of conveyor systems (particularly the slats and subdecks) that solves many of the problems of known reciprocating conveyors and, additionally, reduces complexity, expense, weight, and installation time. This section addresses some of the advantages and features of preferred embodiments of the present invention.

Preferred embodiments of the present invention reduce or eliminate leakage between the slats **20** and the subdecks **30** for security and cleanliness. Leakage out of the conveyor system **10** is extremely undesirable for shredded confidential documents as well as other loads. Leakage into the conveyor system (e.g. road contaminants) is also extremely undesirable for certain types of loads (e.g. grains and other foodstuff). One way that this is accomplished is the use of the longitudinal trough-like containment subdecks **30** positioned between longitudinal side edges **24***a*, **24***b* of adjacent slats **20** so as to catch the fine particulate matter that sifts between the moving slats **20** and prevent it from escaping the conveyor **10**. Another way that this is accomplished is the use of a double-seal system **48***a*, **48***b*. The first seal **48***a* is the overlapping of adjacent slat side edges **24***a*, **24***b* (accomplished in some preferred embodiments using, for example, the raised sealing longitudinal projection **28**). This first seal **48***a* substantially prevents communication of fine particulate matter or other contaminates between the load-holding compartment and the trough-like containment subdecks **30**. The second seal **48***b* is the seal formed between the longitudinal edges of the slats and the longitudinal edges of the subdecks. Significantly, this second seal **48***b* is not at the bottom of the trough-like containment subdecks **30**, but is raised to make it more difficult to breach. This second seal can be a "maze" through which it would be difficult for matter travel. In the shown exemplary preferred embodiments, at least part of this second seal **48***b* is formed when the top surfaces of the slat engagers **36***a*, **36***b* are in

substantially coextensive and sliding relationship with the bottom surface **22***b* of the slats **20**. In the shown exemplary preferred embodiments, at least part of this second seal **48***b* is formed when the slat engagers **36***a*, **36***b* are in substantially coextensive and sliding relationship with the slat legs **26***a*, **26***b*. As mentioned above, the strength of this second seal is enhanced if the channel fills because the load particulate matter lifts the slats so that the slat legs **26***a*, **26***b* (the "L-shaped portion") makes a stronger contact with the lower surface of the subdeck slat engagers **36***a*, **36***b*. Both the first and second seals are accomplished without adding components or otherwise compromising the simplicity of the present invention.

Preferred embodiments of the present invention reduce or eliminate leakage between the slats **20** and the subdecks **30** for security and cleanliness. Leakage out of the conveyor system **10** is extremely undesirable for shredded confidential documents as well as other loads. Leakage into the conveyor system (e.g. road contaminants) is also extremely undesirable for certain types of loads (e.g. grains and other foodstuff). One way that this is accomplished is the use of the longitudinal trough-like containment subdecks **30** positioned between longitudinal side edges **24***a*, **24***b* of adjacent slats **20** so as to catch the fine particulate matter that sifts between the moving slats **20** and prevent it from escaping the conveyor **10**. Another way that this is accomplished is the use of a double-seal system **48***a*, **48***b*. The first seal **48***a* is the overlapping of adjacent slat side edges **24***a*, **24***b* (accomplished in some preferred embodiments using, for example, the raised sealing longitudinal projection **28**). This first seal **48***a* substantially prevents communication of fine particulate matter or other contaminates between the load-holding compartment and the trough-like containment subdecks **30**. The second seal **48***b* is the seal formed between the longitudinal edges of the slats and the longitudinal edges of the subdecks. Significantly, this second seal **48***b* is not at the bottom of the trough-like containment subdecks **30**, but is raised to make it more difficult to breach. This second seal can be a "maze" through which it would be difficult for matter travel. In the shown exemplary preferred embodiments, at least part of this second seal **48***b* is formed when the top surfaces of the slat engagers **36***a*, **36***b* are in substantially coextensive and sliding relationship with the bottom surface **22***b* of the slats **20**. In the shown exemplary preferred embodiments, at least part of this second seal **48***b* is formed when the slat engagers **36***a*, **36***b* are in substantially coextensive and sliding relationship with the slat legs **26***a*, **26***b*. As mentioned above, the strength of this second seal is enhanced if the channel fills because the load particulate matter lifts the slats so that the slat legs **26***a*, **26***b* (the "L-shaped portion) makes a stronger contact with the lower surface of the subdeck slat engagers **36***a*, **36***b*. Both the first and second seals are accomplished without adding components or otherwise compromising the simplicity of the present invention.

Preferred embodiments of the conveyor system **10** also have a reduced installed weight because the floor can be constructed of light-weight materials. The deck weight reduction may be as significant as half the weight of comparable decks formed from aluminum slats. Normally, light-weight material would buckle due to longitudinal forces and/or other forces so using light-weight material is not a simple substitution, but required a complete redesign. In preferred embodiments the subdecks **30** and the deck slats **20** have been redesigned so that light-weight material is closely engaged and longitudinally side-supported by adequately stiff material to prevent buckling. In the shown embodiments, the slat **20** and subdeck **30** design provides the weak slats **20** with improved support against buckling.

Still another example is that in preferred embodiments the slats **20** and subdecks **30** are designed so that the slats **20** are supported near their longitudinal edges by the parallel spaced subdecks **30** such that the center of each slat **20** has a longitudinal opening **31** (the span between the subdecks **30**) into which the drive mechanism (e.g. the cross-drive shoe **46**) can be placed. This enables both the subdecks **30** and the slats **20** to be continuous from the front of the load-holding compartment to the back of the load-holding compartment. This has the effect of increasing strength and decreasing installation time.

Preferred embodiments of the conveyor system **10** also increase the vertical and lateral strength of the floor as compared to prior art conveyor systems. Preferred embodiments of the conveyor system **10** of the present invention include the feature of lower operation pressures (because there is less friction when cycling). Preferred embodiments of the conveyor system **10** of the present invention include the feature of tighter end seals (as compared to the end seals of aluminum slats). The ends of the slats and subdecks shown in known references are difficult to seal because the open gap is also the joint between two adjacent slats. The present invention allows this difficult area to be open since it is contained by the trough-like subdeck. The open ends of the slats are now easier to seal because they are bounded only by the lower surface of the slat and the outside walls of adjacent subdecks.

It should be noted that because the subdecks **30** support the slats **20**, no additional support is needed to support the slats even though preferred embodiments are made from light weight material. This can be compared to U.S. Pat. No. 4,727,978 which requires additional structures such as tubular support members to support the slats. Another advantage over this reference includes that no bearings are needed for the present invention. Finally, because the slat engagers **36***a*, **36***b* of the subdecks **30** engage (form an additional seal) the slat legs **26***a*, **26***b* of the slats **20**, vertical movement between the subdecks **30** and slats **20** is substantially reduced or eliminated. Also, because this "seal" (between the subdeck slat engagers **36***a*, **36***b* and the slat legs **26***a*, **26***b*) is raised, it would be more difficult for particulate matter to escape than the lower connection between the slats and trough in U.S. Pat. No. 4,727,978.

It should also be noted that, although preferred embodiments of the subdecks **30** are able to catch and contain debris and particulate matter, the overlapping slats **20** prevent the majority of debris and particulate matter from entering the channels of the subdecks **30**. This is significant because it avoids problems associated with designs that encourage matter to enter the channels (e.g. U.S. Pat. No. 4,611,708).

Method of Installation of the Double-Sealed, Bearingless, Reciprocating Slat-Type Conveyor

An exemplary conveyor system **10** of the present invention may be installed using an exemplary basic installation method, the steps of which would be modified based on variables including, but not limited to materials, sizes, locations, and intended applications. The figures of this application, particularly FIG. **6**, are useful in understanding this method. First, the drive mechanisms (e.g. the cross-drives, cross-drive shoes, and the power units) are installed in, below, or otherwise near the load-holding compartment **12**. Before the subdecks **30** are installed, both the number of moving slats **20** (as opposed to stationary side trim slats) and the clearances (e.g. front and rear clearances) should be determined and planned. If the number of moving slats **20** is

even (even deck number), an odd number of subdecks **30** are used with one subdeck **30** centered on and anchored to the load-holding compartment **12** centerline. If the number of moving slats **20** is odd (odd deck number), an even number of subdecks **30** are used with two subdecks **30** centered about and anchored to the load-holding compartment **12** centerline. A spacer jig can be used to position the remaining subdecks **30**. End caps **50** are positioned and secured at the ends of the subdecks **30** as shown (e.g. between two subdecks). Next, the deck slats **20** can be installed onto the subdecks **30** by sliding the slats **20** onto the subdecks **30** from the end. When everything is in the correct position, the slats **20** may be secured to their respective cross-drive shoes **46**. Side trim made from a whole or a partial (ripped) deck slat **20** may be added at this point. Also, a sloped sheet with a wiper may be added at this point.

Tipper Retrofit Bearingless Reciprocating Slat-Type Conveyor Assembly

As discussed in the Background, there are many trailers produced for the sole function of being loaded through the open ceiling of the trailer with municipal waste, being driven to a landfill, and being loaded onto a tipping platform and tipped to great heights to dump the load of waste out the rear door (gate). These trailers are most often called "tipper trailers." Exemplary tipper trailers are shown and discussed in U.S. Pat. No. 6,019,568 to Bratlie, U.S. Pat. No. 6,860,695 to Chapman et al., and U.S. Pat. No. 7,100,972 to Booher. These references are herein expressly incorporated by reference in their entirety. Many tipper trailer operators find that they are no longer being routed to destinations that have tipping platforms. If the new destinations do not have a tipping platform to unload the tipper trailer, the tipper trailer is useless. The tipper retrofit reciprocating slat-type conveyor assembly described herein may be used to retrofit a tipper trailer with a reciprocating slat-type conveyor. The converted tipper trailer can be used at destinations that do not have a tipping platform.

A reciprocating slat-type conveyor can be created using a front mount hydraulic drive unit (fulfilling the function of a power unit or a function similar thereto) by driving spaced apart slats installed on top of the trailer's existing floor. The missing component is a lightweight quickly installed reciprocating slat-type conveyor assembly. FIGS. **14-16** show a tipper retrofit reciprocating slat-type conveyor assembly that is lightweight quickly installed reciprocating slat-type conveyor assembly **200** that includes slats **210**. (As will be discussed, FIGS. **37-42** show an alternative tipper retrofit reciprocating slat-type conveyor assembly.) The lightweight reciprocating slat-type conveyor assembly includes elongate hold down strips **220** (FIG. **15**) and elongate guide trough subdecks **230** (FIG. **16**) that support the slats **210**. The shown reciprocating slat-type conveyor assembly is free from distinct bearing elements between the subdecks **230** and the slats **210**.

As shown in detail in FIG. **15**, each elongate hold down strip **220** is formed in a U-shape such that any cross-section along its length would have a longitudinal base **222***a* with upward longitudinal fingers **222***b* (side walls). The fingers **222***b* are shown as being on either end/side of the base **222***a* and at a substantially right angle thereto. Each upward finger **222***b* has subdeck engaging structure (shown as longitudinal barbs **224** projecting outwardly from each finger **222***b*). Preferably, the barbs **224** extend outwardly from the top half of the upward fingers **222***b*. This hold down strip **220** is installed on the trailer floor **202** (the floor of the load-holding compartment). In preferred embodiments, an elongate hold down strip **220** is installed parallel to and substantially adjacent (albeit with a small space therebetween) along the longitudinal sides of the floor **202** of the trailer. Additional hold down strips **220** may be installed in the longitudinal center of the floor **202** of the trailer or at spaced intervals on the floor **202** of the trailer. A plurality of laterally spaced and substantially parallel hold down strips **220** would make a stripe-like pattern of parallel hold down strips **220**.

As shown in detail in FIG. **16**, the elongate guide trough subdecks **230** are laid down to span the floor **202** of the trailer. The shown guide trough subdecks **230** have an elongate span **232** with two sides. At each side of the subdeck span **232** there is an upside-down U-shaped elongate slat support **234**. Projecting towards the span **232** from the "outside" (the outside elongate side surface) of the slat support **234** is a slat engaging structure (shown as barbs **236**). On the end of the "fingers" (the longitudinal wall) of at least one upside-down U-shaped slat support **234**, and specifically from the "inside" (or underside) surface of the slat support **234**, is a hold down strip engaging structure (shown as barb engaging structures **238**) to interact with the subdeck engaging structure (shown as barbs **224**) of the hold down strip **220**. Each guide trough subdeck **230** supports two slats **210**, one on each side of the upside-down U-shaped slat supports **234**.

Multiple guide trough subdecks **230** that extend the length of the trailer are positioned adjacent each other across the width of the trailer. The two outer guide trough subdecks **230** may be snapped onto hold down strips **220** that have been installed on the floor **202**. For each of the two outer guide trough subdecks **230**, one side (the upside-down U-shaped slat support **234**) may be snapped down onto the hold down strip **220** so that the structure **238** interacts with (shown as being longitudinally positioned under) the barbs **224** of the hold down strip **220**. Two guide trough subdecks **230** near the center of the trailer may also be snapped down onto centrally located hold down strips **220**. The rest of the guide trough subdecks **230** may be allowed to float freely between these "held down" guide trough subdecks **230**.

The shown slats **210** have an upper surface **212** with a substantially downwardly projecting leg **214** on each side. Each leg **214** has an inwardly projecting longitudinal subdeck engaging structure **216**. The inwardly projecting subdeck engaging structure **216** is shown as a folded longitudinal end of the legs **214**. Each slat **210** is supported by two guide trough subdecks **230**. When the slats **210** are supported on the subdecks **230** the subdeck engaging structure **216** engages the slat engaging structure (shown as barbs **236**), but the slats **210** may move longitudinally in relation to the subdecks **230** to produce the patterns therebetween. The size of each guide trough subdeck **230** determines the space between two adjacent slats **210**.

In this preferred tipper retrofit, bearingless, reciprocating slat-type conveyor assembly, the guide trough subdecks **230** may be made of a first material and the slats **210** are made of a second material dissimilar to the first material. In this preferred double-sealed, bearingless, reciprocating slat-type conveyors, the second material is stiffer than the first material.

Since the slats **210** are guided and supported by the guide trough subdecks **230** and since the guide trough subdecks **230** and slats **210** work together to maintain proper spacing between the slats **210** there is no need for a separate "bearing" component. There is no need to fasten every guide trough subdeck **230** to the floor **202** because the slats **210** and guide trough subdecks **230** form an interlocking chain across the floor **202**. So just as a chain can be prevented from lifting by attaching only several links separated by a distance

so the slat system can be held down by fastening (with hold down strips **220**) only several guide trough subdecks **230** separated by a distance across the floor **202**.

The hold down strip **220** prevents the guide trough subdecks **230** from lifting off the floor of the trailer. In preferred assemblies, no more than four hold down strips **220** are required to support the whole trailer width of guide trough subdecks **230** and slats **210**. In other words, this system requires relatively few fasteners or fasten points as compared with standard systems. Few fasteners or fasten points means much less installation time and materials. The system is also considerably lighter weight than the standard system because it does not require metal guide beams.

Although the retrofit, bearingless, reciprocating slat-type conveyor assembly described herein is discussed in terms of use with tipper trailers, it should be noted that the assemblies may be used with alternative types of trailers or other load-holding compartments of transport vehicles.

The advantages of the tipper retrofit reciprocating slat-type conveyor assembly **200** (FIGS. **14-16**) are also present in the alternative tipper retrofit reciprocating slat-type conveyor **200'** shown in FIGS. **37-42**. FIGS. **37** and **38** show views of the alternative tipper retrofit reciprocating slat-type conveyor assembly **200'** that may be used for converting a tipper trailer. The alternative tipper retrofit reciprocating slat-type conveyor **200'** includes elongate hold down strips **220'** (FIG. **39**) and elongate guide trough subdecks **230'** and **230"** (FIGS. **40** and **41**) that support the slats **210'** (FIG. **42**). The shown alternative reciprocating slat-type conveyor **200'** assembly is free from distinct bearing elements between the subdecks **230'** and the slats **210'**.

As shown in detail in FIG. **42**, the slat profile **210'** can be described as an over bent C-channel oriented horizontally so that the flanges (side walls) extend from the web (base) in a downward and inward angle.

As shown in detail in FIG. **41**, the elongate guide trough subdecks **230"** are laid down to span the floor **202** of the trailer. The shown guide trough subdecks **230"** have an elongate span **232'** with two sides. At each side of the subdeck span **232'** there is an upside-down U shape elongate slat support **234'**. The inner leg **236'**, of the upside-down U shape that attaches to the elongate span **232'**, projects upward from and slants inward over the elongate span **232'** at an angle that is not vertical. The top of the upside down U shape extends horizontally from the slat support leg **236'** in a direction parallel to and away from the elongate span **232'**. The outer leg (vertical leg) **237'** of the upside-down U shape extends vertically downward to the plane on which the elongate span **232'** rests.

As shown in detail in FIG. **39**, each elongate hold down strip **220'** can be described as an over bent C-channel oriented horizontally so that the flanges (side walls) extend from the web (base) in a downward and inward angle. The hold down strip profile is offset inside from the profile of the two adjacent upside-down U shape elongate slat supports **234'** of adjacent subdecks. The hold down strip profile appears to be a scaled down version of the slat profile.

As shown in detail in FIG. **38**, each slat is supported by two adjacent subdecks. The slanting legs of the upside-down U shape slat supports **234'** and the horizontal slat supporting surfaces form a profile that is offset inside from the profile of the slat such that relative motion between the slat and the subdecks is limited in all directions except longitudinal. The vertical legs **237'** of adjacent subdecks upside-down U shape slat supports **234'** are substantially touching each other and are located at substantially the center of the slat they support.

The vertical legs **237'** of adjacent subdecks must be removed **230'** wherever a hold down strip will be located. Hold down strips are installed parallel to and substantially adjacent (albeit with a small space therebetween) along the longitudinal sides of the floor **202** of the trailer. Additional hold down strips **220'** may be installed in the longitudinal center of the floor **202** of the trailer or at spaced intervals on the floor **202** of the trailer. A plurality of laterally spaced and substantially parallel hold down strips **220'** would make a dashed striped pattern of parallel hold down strips **220'**.

Snap Together Bearingless Reciprocating Slat-Type Conveyor Assembly

Cross-members are well known in the art. U.S. Pat. No. 4,144,963 to Hallstrom, U.S. Pat. No. 4,184,587 to Hallstrom, U.S. Pat. No. 4,785,929 to Foster, U.S. Pat. No. 5,482,155 to Foster, U.S. Pat. No. 6,763,933 to Wilkens, U.S. Pat. No. 7,152,729 to Wilkens, and U.S. Patent Publication No. 2003/0178546 to De Raad are all herein incorporated by reference in their entirety.

FIGS. **17-26** and FIGS. **27-36** show two closely related snap together reciprocating slat-type conveyor assemblies **300**, **400** that are free from distinct bearing elements between the slats **310**, **410** and the subdecks **330**, **430**. The main distinctions between the snap together reciprocating slat-type conveyor assemblies **300** shown in FIGS. **17-26** and the snap together reciprocating slat-type conveyor assemblies **400** shown in FIGS. **27-36** are as follows: the length and size of the interlocking barb **326**, **426** (and interlocking projection **340**, **440**) are different; the one version has guide ribs and slots in the slat supports ("tubes") of the bearing subdecks and the other does not; and there is a difference in the thickness of the anchor hooks **324**, **424** and subdeck hooks **344**, **444**. For purposes of simplicity, the variations of the snap together reciprocating slat-type conveyor assemblies **300**, **400** will be described together.

The snap together reciprocating slat-type conveyor assemblies **300**, **400** have several advantages. First, the anchors **320**, **420** and subdecks **330**, **430** are not permanently attached to the cross-members **302**, **402**. As compared to traditional attachment solutions that require drilling/bolting, welding, or other more permanent attachment solutions, the non-permanent attachment solution use for attaching the snap together reciprocating slat-type conveyor assemblies **300**, **400** to the cross-members **302**, **402** means that the cross-members **302**, **402** are not damaged. This means that the integrity of the cross-members **302**, **402** remains in tact. Further, because the cross-members **302**, **402** are not damaged the snap together reciprocating slat-type conveyor assemblies **300**, **400** can be easily removed and replaced without having to worry about matching drill holes. Second, the snap together reciprocating slat-type conveyor assemblies **300**, **400** are self-aligning. When the slats **310**, **410** are attached, the snap together reciprocating slat-type conveyor assemblies **300**, **400** can slide along the cross-members **302**, **402** to the proper position. Similarly, the snap together reciprocating slat-type conveyor assemblies **300**, **400** limit the distance between the slats **310**, **410** (holds them at the proper distance, not too close or too far apart). Third, the snap together reciprocating slat-type conveyor assemblies **300**, **400** can be installed without removing the slats **310**, **410** (replaced from underneath).

The snap together reciprocating slat-type conveyor assemblies **300**, **400** are directly supported by the cross-members **302**, **402** of a trailer or other load-holding compartment of a transport vehicle. Specifically, the reciprocating slat-type conveyor assemblies **300**, **400** engage an overhang (e.g. the top flange, upper surface, and/or lip) of

the cross-members **302**, **402**. The cross-members **302**, **402**, therefore, may be, for example, a channel cross-member (as shown), an I-Beam channel cross-member, a completely flat channel cross-member, or a T-shaped channel cross-member. In the shown snap together reciprocating slat-type conveyor assemblies **300**, **400**, the anchors **320**, **420** grip different widths of cross-members **302**, **402** (or at least the top of the cross-members **302**, **402**). This is accomplished by using opposing and interlocking anchors **320**, **420** and subdecks **330**, **430** that, when pushed together around the cross-member overhang, cannot be separated easily.

As shown in detail in FIGS. **18** and **27**, preferred anchors **320**, **420**, when viewed in cross-section, are Y-shaped, having an upper anchor subdeck engager shown as being U-shaped (e.g. the anchor trough **322**, **422**) and a lower anchor cross-member engager shown as a projection (e.g. the anchor hook **324**, **424**). (It should be noted that alternative upper subdeck engagers could have alternative cross-sections. For example, they could be a solid rectangle.) The anchor trough **322**, **422** is shown as being relatively long (when compared to the anchor hook **324**, **424**) having a midsection and two upwardly projecting sides. The anchor hook **324**, **424**, may extend under the cross-member **302**, **402** with the snap together reciprocating slat-type conveyor assemblies **300**, **400** thereon. The anchor trough **322**, **422** has at least one anchor interlocking structure (shown as interlocking barb **326**, **426**) on its outer surface towards the end of the anchor trough **322**, **422** to be inserted into a slat support **334**, **434** of a subdeck **330**, **430**. The length and size of the interlocking barbs **426** shown in FIG. **27** are longer than the interlocking barbs **326** shown in FIG. **18**. The variation in FIG. **27** is shown as having a "thicker" anchor hook **424** than the subdeck hooks **344** shown in FIG. **18**. Although shown as a having a single anchor trough **322**, **422** and a single anchor hook **324**, **424**, variations could include multiple anchor troughs **322**, **422** and/or multiple anchor hooks **324**, **424**.

The subdecks **330**, **430** have an upper subdeck anchor-slat engager (shown as at least one slat support **334**, **434** that engages both anchors **320**, **420** and slats **310**, **410**) and a lower subdeck cross-member engager (shown as at least one subdeck hook **344**, **444** that engages the cross-members **302**, **402**).

As shown in detail in FIGS. **18** and **27**, the upper anchor-slat engager portion of the subdecks **330**, **430** may include a span **332**, **432** (also referred to as a "subdeck span") with two sides, a top surface, and a bottom surface. At each side of the subdeck span **332**, **432**, and projecting upwards from the top surface, there is a generally upside-down U-shaped (tunnel) slat support **334**, **434** that preferably functions as a bearing upon which the slats **310**, **410** may slide longitudinally. (The shown anchor-slat engager portion of the subdecks **330**, **430** includes a pair of slat supports **334**, **434** separated by a subdeck span **332**, **432**.) A first end (the "entrance end") of each slat support **334**, **434** functions as an entrance into which an anchor trough **322**, **422** may be inserted. A second end (the "exit end") of each slat support **334**, **434** functions as an exit for the interlocking barbed end of the anchor trough **322**, **422** to engage and interlock. Projecting towards the span **332**, **432** from the inside wall (the span side) of slat support **334**, **434** is a slat engaging structure (shown as slat engaging barbs **336**, **436**). On the free end of the downward-projecting walls of each upside-down U-shaped slat support **334**, **434** are inwardly projecting anchor engaging structures **338**, **438** to engage with the bottom surface of the anchor trough **322**, **422** of the anchors **320**, **420**. The anchor hook **324**, **424** slides between the anchor engaging structures **338**, **438**. (The anchor engaging structures **338**, **438** may be implemented as a notch such as that shown in FIGS. **22** and **31**.) At the second end (the "exit end") of each slat support **334**, **434** is at least one subdeck interlocking structure (shown as inward interlocking projections **340**, **440**) that engage and interlock with the interlocking barbed end of the anchor trough **322**, **422**. The at least one inward interlocking projection **340**, **440** may be multiple inward projections or a lip that extends along all or part of the exit end. The shown interlocking barb(s) **326**, **426** and interlocking projection(s) **340**, **440** function similar to a cable tie in that it is easy to insert, but difficult (or impossible) to separate. Further, like a cable tie, the interlocking barb(s) **326**, **426** and interlocking projection(s) **340**, **440** allow the installer to "tighten" the device to the proper "tightness." This allows the system to grip cross-members **302**, **402** of different widths. The subdeck **330** of FIG. **18** also includes guide ribs and slots in the slat support **334** that are not present in the subdeck **430** of FIG. **27**. Although the subdecks **330**, **430** are shown as having two slat supports **334**, **434**, variations could include more or fewer slat supports **334**, **434** (with appropriate subdeck spans **332**, **432** therebetween if there are multiple slat supports **334**, **434**).

As shown in FIGS. **21-23** and FIGS. **30-32**, the at least one lower cross-member engager (shown as two subdeck hooks **344**, **444**) may project downward from the bottom surface of the subdecks **330**, **430** (shown as projecting from the subdeck span **332**, **432**). The subdeck hooks **344**, **444**, may extend under the cross-member **302**, **402** with the snap together reciprocating slat-type conveyor assemblies **300**, **400** thereon. Although shown as having two subdeck hooks **344**, **444**, variations could include more or fewer subdeck hooks **344**, **444**. The variation in FIGS. **30-32** is shown as having "thicker" subdeck hooks **444** than the subdeck hooks **344** shown in FIGS. **21-23**.

FIGS. **25** and **35** shows how a cross-member **302**, **402** is gripped by at least one anchor **320**, **420** and at least one subdeck **330**, **430**. The anchor(s) **320**, **420** and the subdeck **330**, **430** are first generally positioned (the position does not have to be exact) so that the top portion of the anchor(s) **320**, **420** and the subdeck **330**, **430** are above the "overhang" of a cross-member **302**, **402** and the bottom portions of the anchors **320**, **420** and subdecks **330**, **430** (in particular the anchor hooks **324**, **424** and the subdeck hooks **344**, **444**) are below the "overhang" of the cross-member **302**, **402**. The end of the anchor trough **322**, **422** having interlocking barb(s) **326**, **426** is inserted into the entrance end of a respective slat support **334**, **434**. The anchor(s) **320**, **420** and the subdeck **330**, **430** are then pushed together until the interlocking barb(s) **326**, **426** and interlocking projection(s) **340**, **440** begin to engage and interlock. Pushing the anchor(s) **320**, **420** and the subdeck **330**, **430** together further, the interlocking barb(s) **326**, **426** and interlocking projection(s) **340**, **440** allow the installer to "tighten" the device to the proper "tightness." Once in position, the anchor hooks **324**, **424** and the subdeck hooks **344**, **444** are positioned under the "overhang" of a cross-member **302**, **402** such that the anchor(s) **320**, **420** and the subdeck **330**, **430** cannot be pulled upward. (The anchor hooks **324**, **424** and the subdeck hooks **344**, **444** can be thought of as acting together like a claw or pincher gripping or pinching the cross-member **302**, **402**.) The anchor(s) **320**, **420** and the subdeck **330**, **430**, however, can be slid sideways for adjustment. Two adjacent combinations of anchor(s) **320**, **420** and subdecks **330**, **430** are used to support a single slat **310**, **410**. The slat **310**, **410** is installed so that the insides of the slat legs (and associated projections thereon) engage with the

slat engaging structure (shown as slat engaging barbs **336**, **436**). The actual installation may be accomplished by sliding the slats **310**, **410** onto the slat support **334**, **434** or "snapping" them into place by simply pushing the slats **310**, **410** onto the slat support **334**, **434**. How the slats are installed may depend on factors such as the material from which the slats **310**, **410** are made and the flexibility thereof.

As shown in FIGS. **19-20** and FIGS. **28-29**, each cross-member **302**, **402** may be gripped by a plurality of snap together reciprocating slat-type conveyor assemblies **300**, **400**. The subdecks **330**, **430** engage the anchors **320**, **420**. The slats **310**, **410** engage the subdecks **330**, **430**. (The shown slats are similar to the slats **210** in that they have an upper surface with a substantially downwardly projecting leg **214** on each side.) Each leg has an inwardly projecting longitudinal subdeck engaging structure. The inwardly projecting longitudinal subdeck engaging structure engages with the slat engaging structure (shown as slat engaging barbs **336**, **436**).) Each of the subdecks **330**, **430** guides and supports two slats **310**, **410**. The slats **310**, **410** are prevented from moving vertically or laterally relative to the subdecks **330**, **430** while being able to move longitudinally relative to the subdecks **330**, **430**. Put another way, the snap together reciprocating slat conveyor assemblies **300**, **400** are shown as having slats **310**, **410** guided and supported by subdecks **330**, **430** that are, in turn, supported by trailer cross-members **302**, **402**.

The subdecks **330**, **430** are oriented adjacent each other along the cross-member **302**, **402** so that the subdecks **330**, **430** substantially span the width of the load-holding compartment. This orientation causes the maximum gap **346**, **446** (shown in FIGS. **19** and **28**) between two adjacent slats **310**, **410** to be constrained by one subdeck **330**, **430**. The minimum gap **348**, **448** (shown in FIGS. **20** and **29**) between two adjacent slats **310**, **410** is constrained by the relationship between a central subdeck **330**, **430** and its two adjacent subdecks **330**, **430** (three consecutive subdecks **330**, **430**) that are together supporting the two slats **310**, **410**. Bearings between the subdecks **330**, **430** and the cross-members **302**, **402** are not needed to properly constrain the minimum and maximum gaps between the slats **310**, **410**.

Both the anchors **320**, **420** and the subdecks **330**, **430** may be made using injection molded high-density polyethylene (HDPE). The shown subdecks **330**, **430** are preferably made of a slippery material (e.g. anti-friction material such as synthetic thermoplastic resin such as Teflon®, Delrin®, polyethylene, etc., or other suitable material having a low coefficient of friction) and the slats **310**, **410** are metal or other material that is stiffer than the material from which the subdecks **330**, **430** are made. In preferred snap together reciprocating slat-type conveyor assemblies **300**, **400**, the guide trough subdecks **330**, **430** may be made of a first material and the slats **310**, **410** may be made of a second material dissimilar to the first material. In preferred snap together reciprocating slat-type conveyor assemblies **300**, **400**, the second material is stiffer than the first material.

DEFINITIONS

The term "seal," as used in the present invention, is not generally meant to mean a complete and absolute barrier. Instead, the term "seal" is meant to mean an intended and substantial barrier to entry. Accordingly, it is possible that some matter will pass the first seal **48***a* and enter the channel formed by the subdeck **30**. Depending on the tolerances and the type of material, the seal may be almost complete.

It should be noted that some terms used in this specification are meant to be relative. For example, the terms "longitudinal" and "transverse" are meant to be relative and, if the system was rotated, the terms would change accordingly. Similarly, the term "front" is meant to be relative to the term "rear" and the term "top" is meant to be relative to the term "bottom." It should be noted that, unless otherwise specified, the term "or" is used in its nonexclusive form.

All the references cited herein are incorporated by reference.

The terms and expressions that have been employed in the foregoing specification are used as terms of description and not of limitation, and are not intended to exclude equivalents of the features shown and described or portions of them. The scope of the invention is defined and limited only by the claims that follow.

What is claimed is:

1. A reciprocating slat conveyor for use in a load-holding compartment, said reciprocating conveyor comprising:

(a) a plurality of elongate hold down strips, each hold down strip having subdeck engaging structure;

(b) a plurality of elongate guide trough subdecks, each elongate guide trough subdeck having an elongate span between elongate slat supports, each elongate guide trough subdeck having slat engaging structure, and at least one elongate slat support having hold down strip engaging structure; and

(c) a plurality of longitudinal slats adjacent to and parallel to each other, each slat having a plurality of substantially downwardly projecting legs, each leg having subdeck engaging structure;

wherein each one of said plurality of elongate hold down strips is positioned below a single one of said elongate slat supports; and

wherein said plurality of elongate hold down strips are laterally spaced and substantially parallel on a floor of said load-holding compartment, said hold down strip engaging structure engaging said subdeck engaging structure, and said slat engaging structure engaging said subdeck engaging structure to allow longitudinal movement of said longitudinal slats.

2. The reciprocating slat conveyor of claim **1**, said plurality of elongate guide trough subdecks made of a first material, said plurality of longitudinal slats made of a second material dissimilar to said first material.

3. The reciprocating slat conveyor of claim **1**, said plurality of elongate guide trough subdecks made of a first material, said plurality of longitudinal slats made of a second material dissimilar to said first material, said first material being stiffer than said second material.

4. The reciprocating slat conveyor of claim **1** wherein said conveyor is free from distinct bearing elements between said subdecks and said slats.

5. The reciprocating slat conveyor of claim **1** further comprising:

(a) said plurality of elongate hold down strips having a longitudinal base and upward longitudinal fingers on either side thereof, said subdeck engaging structure being longitudinal barbs projecting outwardly from each longitudinal finger;

(b) said slat engaging structure projecting towards said elongate span from an outside elongate side surface of each elongate slat support, said hold down strip engaging structure projecting inward from an inside surface of said elongate slat support; and

(c) said subdeck engaging structure being an inwardly projecting longitudinal subdeck engaging structure.

6. The reciprocating slat conveyor of claim 1, said load-holding compartment being a tipper trailer and said reciprocating slat-type conveyor being a lightweight and quickly installable reciprocating slat conveyor.

7. The reciprocating slat conveyor of claim 1 wherein each one of said elongate slat supports is an upside-down U-shaped elongate slat support.

8. The reciprocating slat conveyor of claim 1, each one of said elongate slat supports being an upside-down U-shaped elongate slat support, wherein, in use, each one of said plurality of elongate hold down strips is positioned below an upside-down U-shaped elongate slat support.

9. A reciprocating slat conveyor for use in a load-holding compartment having at least one cross-member having an overhang, said overhang has a lower surface, said reciprocating conveyor comprising:

(a) at least one reciprocating slat-type conveyor assembly comprising:

(i) at least one anchor having at least one upper anchor subdeck engager and at least one lower anchor cross-member engager; and

(ii) at least one subdeck having at least one upper subdeck anchor-slat engager and at least one lower subdeck cross-member engager;

(iii) wherein when said at least one anchor subdeck engager and said at least one subdeck anchor-slat engager are engaged, said at least one anchor cross-member engager and said at least one subdeck cross-member engager engage said lower surface of said overhang of said cross-member; and

(b) at least one elongate slat at least partially supported by said at least one subdeck.

10. The reciprocating slat conveyor of claim 9, said at least one upper anchor subdeck engager being at least one anchor trough and said at least one lower anchor cross-member engager being at least one anchor hook.

11. The reciprocating slat conveyor of claim 9, said at least one upper subdeck anchor-slat engager being at least one slat support and said at least one lower subdeck cross-member engager being at least one subdeck hook.

12. The reciprocating slat conveyor of claim 9, said at least one upper anchor subdeck engager being an anchor trough and said at least one lower anchor cross-member engager being an anchor hook, said at least one upper subdeck anchor-slat engager being a pair of slat supports separated by a subdeck span and said at least one lower subdeck cross-member engager being a pair of subdeck hooks.

13. The reciprocating slat conveyor of claim 9, said at least one anchor subdeck engager being insertable into said at least one subdeck anchor-slat engager.

14. The reciprocating slat conveyor of claim 9, said at least one anchor subdeck engager having anchor interlocking structure, and said at least one subdeck anchor-slat engager having subdeck interlocking structure, wherein said anchor interlocking structure and said subdeck interlocking structure to interlock said at least one anchor in relation to said at least one subdeck.

15. The reciprocating slat conveyor of claim 9, said at least one anchor cross-member engager being at least one anchor hook and said at least one subdeck cross-member engager being at least one subdeck hook, at least part of one of said at least one anchor hook and said at least one subdeck hook being positioned below said overhang of said cross-member to prevent vertical movement of said at least one reciprocating slat-type conveyor assembly in relation to said cross-member.

16. The reciprocating slat conveyor of claim 9, wherein installation of said at least one reciprocating slat-type conveyor assembly does not damage said cross-member.

17. The reciprocating slat conveyor of claim 9 wherein said conveyor is free from distinct bearing elements between said subdecks and said slats.

18. The reciprocating slat conveyor of claim 9, wherein said subdecks are made of a first material and said slats are made of a second material dissimilar to said first material.

19. The reciprocating slat conveyor of claim 9, wherein said subdecks are made of a first material and said slats are made of a second material dissimilar to said first material, said first material being stiffer than said second material.

20. A reciprocating slat conveyor for use in a load-holding compartment having at least one cross-member having an overhang, said reciprocating conveyor comprising:

(a) at least one reciprocating slat-type conveyor assembly comprising:

(i) at least one anchor having at least one upper anchor subdeck engager and at least one lower anchor cross-member engager;

(ii) at least one subdeck having at least one upper subdeck anchor-slat engager and at least one lower subdeck cross-member engager; and

(iii) wherein when said at least one anchor subdeck engager and said at least one subdeck anchor-slat engager are engaged, said at least one anchor cross-member engager and said at least one subdeck cross-member engager engage said cross-member;

(iv) at least one of said at least one lower anchor cross-member engager and said at least one lower subdeck cross-member engager being at least one anchor hook; and

(b) at least one elongate slat at least partially supported by said at least one subdeck.

21. The reciprocating slat conveyor of claim 20, said at least one upper anchor subdeck engager being at least one anchor trough and said at least one lower anchor cross-member engager being at least one anchor hook.

22. The reciprocating slat conveyor of claim 20, said at least one upper subdeck anchor-slat engager being at least one slat support and said at least one lower subdeck cross-member engager being at least one subdeck hook.

23. The reciprocating slat conveyor of claim 20, said at least one upper anchor subdeck engager being an anchor trough and said at least one lower anchor cross-member engager being an anchor hook, said at least one upper subdeck anchor-slat engager being a pair of slat supports separated by a subdeck span and said at least one lower subdeck cross-member engager being a pair of subdeck hooks.

24. The reciprocating slat conveyor of claim 20, said at least one anchor subdeck engager being insertable into said at least one subdeck anchor-slat engager.

25. The reciprocating slat conveyor of claim 20, said at least one anchor subdeck engager having anchor interlocking structure, and said at least one subdeck anchor-slat engager having subdeck interlocking structure, wherein said anchor interlocking structure and said subdeck interlocking structure to interlock said at least one anchor in relation to said at least one subdeck.

26. The reciprocating slat conveyor of claim 20, said at least one anchor cross-member engager being at least one anchor hook and said at least one subdeck cross-member engager being at least one subdeck hook, at least part of one of said at least one anchor hook and said at least one subdeck hook being positioned below said overhang of said cross-

member to prevent vertical movement of said at least one reciprocating slat-type conveyor assembly in relation to said cross-member.

27. The reciprocating slat conveyor of claim **20**, wherein installation of said at least one reciprocating slat-type conveyor assembly does not damage said cross-member.

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